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Telephone Exchange Jubilee.

THREE years ago we celebrated the jubilee of the telephone. We could then pay deserved homage to an individual and had the benefit of a precise date, for the telephone was one man's invention, was the subject of a patent, and consequently had an official date and a definite birthday. The exchange system, on the other hand, was not an invention. It existed before the telephone, though it was indeed a very rare and undeveloped plant, and could have been of little public utility in its then existing form. It was the grafting of the telephone on to the pre-existing stock that permitted the rapid growth throughout the world of telephone exchange plant. The first exchange was established in the United States in 1878. By 1879 companies had been organised in England. There were two. Which had its plant first in operation is uncertain. There is little doubt that both these exchange systems were in operation in the month of August, 1879, but there was no contemporary publication of the fact. The Bell Co. apparently had no "Press view" at that time. The Edison Co., on the other hand, assured that it was inaugurating a service of benefit to the public, took the Press into its confidence and thus we have a notification in *The Times* of September 6th, 1879, that an exchange system had been installed with ten intercommunicating lines, of which *The Times* itself had one. If, then, we take September as the occasion for the celebration of the jubilee of the telephone exchange system in Great Britain, it is because we have this independent and unimpeachable evidence as to date.

Whilst drawing a distinction between the telephone and the exchange system, it is obvious that they are complementary the one to the other. Without the exchange system the telephone would have been of minor utility. Without the telephone the exchange system would have remained just a telegraphic instrumentality of very limited application. Together they formed a means of communication of such value that the use rapidly grew until there are now, it is computed, considerably more than thirty millions of telephone stations throughout the world.

During the fifty years which have elapsed since the introduction of the telephone exchange service it has been the lot of the ELECTRICAL REVIEW to record—and sometimes to forecast—the developments which have successively taken place. Though the principle of the inter-

changeability of lines was well known, the then existing methods were quite unsuited for telephone exchanges. Inventions were numerous and produced in haste to meet rapidly growing public needs. Changes and reconstructions were forced upon exchange authorities, who had to carry out their arduous work without a moment's interruption of the service. The earthed lines with which they started were shortly changed to metallic circuits; instruments with battery calls were displaced by magneto bells and then changed back again to batteries—though common to all subscribers instead of one. From iron to copper conductors; from overhead to underground routes; from varieties of manual switchboard to varieties of automatic switchboards. These are but a few of the milestones on the road of progress. All branches of engineering have utilised to the full the rich scientific discoveries of recent years, and the telephone especially is indebted to such advances. From the early mechanical relay to the modern valve is a wide span, as is also that between a phantom circuit and a carrier circuit. Once Bell had demonstrated the possibility of sending speech vibrations over a telegraph line a new vista of unlimited investigation was opened up, with the result that the telephone engineer filters out the vibrations he does not want and creates new channels upon existing lines. We need to modify our familiar reference to making two blades of grass grow where one grew before. It is rather the making of one blade provide the nutriment of two. The striking developments in the wireless field, and their prompt utilisation by telephone authorities, is one of the most remarkable features in the long-distance transmission of telephone conversations carrying us well beyond what would have been considered possible even during recent years. The connection from an exchange telephone in Sydney, New South Wales, to an exchange subscriber in London was effected a week or two ago. But not content with etheric transmission, it is now proposed to lay a telephone cable across the Atlantic and, as we recorded last week, a landing place has been selected on the Irish Coast.

The pressing problems for telephone authorities have always been the provision for increasing numbers, the transmission over longer distances, and the study of economy in plant and service. Time was when there was talk of a saturation point for telephone stations. One hears that no longer. Increasing numbers may still be looked for even in the countries with the highest percentage of telephones to population. There is some elasticity about populations, but there is a limit to the size of the globe, and when present progress is considered the telephone engineer would seem to have provided already for the possibility that the world at large should be a common exchange, and the trunk operator be able to link up a girdle round about the earth in a period of time compared with which forty minutes seems eternity.

The telephone is but one of numerous triumphs in the electrical sphere during the last half century, but whilst other services have shown a vastly better way of meeting existing needs the telephone exchange created a new service permitting distant conversation between innumerable selective points. There is no need to stress the benefit conferred. Let us not forget it had a beginning and that its growth was not spontaneous. The story is the very old and very simple story of a number of far-sighted business men undertaking a business enterprise in quest of gain who builded better than they knew and whose enterprise has conferred much more advantage upon the world than it yielded material profit to themselves.

132-Kilovolt Cables.

One of the factors that influenced the Central Electricity Board in its choice of 132-kV for the primary grid was the possibility of using underground cables at that voltage. The two sections of 132-kV cables which are to be laid to connect the London 66-kV network to the 132-kV overhead system will have an aggregate route length of 8.6 miles, and will consist, in both cases, of two three-phase circuits, each comprising three 0.2 sq. in. single-core cables of the oil-filled type developed by Mr. Emanueli. Although they have been described as "experimental," in view of the satisfactory results already obtained in Italy and the U.S.A. with cables of this type, this expression is clearly not intended to imply any doubt as to their successful operation. Improvements in manufacture, arising out of experience with existing cables, must result in a lowering of costs and also in less cumbrous connections, so that, when the time comes to reinforce the proposed 66-kV system, a 132-kV system will, no doubt, be super-imposed to deal with the increased transfers brought about by the progressive relegation of power stations in London to a lower operating category. The development of 132-kV cables is desirable for at least four reasons, two of which are discussed in an article entitled "Unappreciated Economies of Higher Electric Pressures," which appears in this issue. These reasons are: (1) lower capital expenditure per kVA transmitted; (2) reduction in losses, including those due to a lower overall thermal resistance and a lower "bunching factor"; (3) saving in ground space; and (4) elimination in many cases of a stage of transformation.

Quite apart from economies effected, the third reason alone would, as our contributor points out, be sufficient justification for the use of the highest practicable voltage for underground cables in a large number of cases; that is to say, the necessity for their use will be physical quite as much as economic. This will be clear from a consideration of the effect of connecting to a 132-kV grid sub-station the 6.6-kV bus-bars of a large power station, either not operating (even if selected) or working for one shift only. For loads of the magnitude to be dealt with in the future, the mere number of 6.6-kV cables needed would make their employment for the connection impossible, so that double transformation, once at the grid sub-station and again at the power station, would be requisite. A relatively high intermediate pressure will, however, only postpone the evil day when the heavy cost of opening up the streets must once again be incurred.

We think the day cannot be far distant when the larger undertakings will be compelled to adopt 132-kV cables for transmission within their own areas of supply, in which case the experience gained by the Central Electricity Board in this direction will be of invaluable assistance.

Electricity for the Home.

No excuse is necessary for the continual reference to the subject of domestic electrification. It is one of the greatest importance to the electricity supply industry, to the electrical manufacturers, and also to the social advancement of this country. Much has already been done in the work, but it is not difficult to realise that so far only the fringe of the subject has been touched. The work is vast, so vast, indeed, that it must of necessity be done by gradual development, in step with the general expansion of the electricity supply industry. For the gradual development to be adequate, however, the maximum efforts of all concerned are wanted now.

The biggest problem to be solved at present is that of supply charges. Supply engineers can no longer point to the manufacturing side as not being sufficiently developed to warrant fully the use of domestic electrical appliances. Electric cookers and radiators have brought such great advantages to the consumer that in many cases they are used freely where the supply charges do not permit of electric heating and cooking being run in competition with gas service—cost for cost. The totally-enclosed type of boiling plate has definitely solved the problem of maintenance charges, and the general acceptance of the principle of including an electric kettle as an essential part of each cooker is making small the complaints against electric cooking on grounds of inefficiency. Electric domestic water heating, too, has reached such a stage of development

that only the adjustment of the supply charges is necessary to permit its general adoption, coupled with reasonable hire and hire-purchase facilities.

In order to give every possible assistance and encouragement to the supply industry and to the manufacturers, and, indeed, to the consumers, in the work of domestic electrification, we have decided to give regularly in the near future more space to the subject, featuring in a special section what has and is being done by progressive undertakings in various parts of the country. We earnestly ask for the co-operation of supply engineers and managers, and also of the manufacturers and others interested, in this respect, by letting us have information for publication of developments concerning "Electricity For The Home." The publication of information about new apparatus, new tariff schemes, propaganda work, and so on, will, we believe, do much to further the work in hand.

It is particularly encouraging to note that practically simultaneously with our own scheme, the British Electrical Development Association is launching an "Electric Homes (Outlet) Campaign" to further the advancement of domestic electrification, to which reference is made elsewhere in this issue. With its wider field of activities and its greater resources E.D.A. will be able to advance greatly the good work already done by the Electrical Association for Women as the result of its own "Outlet" campaign.

E.D.A. has undertaken a big task. The courage and enterprise which have been shown in launching the campaign, and the ability with which the scheme has been designed, are such as to demand the wholehearted support of the industry at large, without which support the campaign cannot attain the success it deserves. The main objects of E.D.A. Electric Homes (Outlet) Campaign are to be fought for by special appeals to the public, to the builder, the landlord, and the architect; but it must be remembered that the public, the builder, the landlord, and the architect, one and all, can only be tackled with anything like success where the supply charges are such as to place electricity supply for domestic purposes on a competitive basis with other public services. The greatest assistance can be given to E.D.A., therefore, by supply undertakings bringing their tariffs down to the lowest possible figure, compatible, of course, with commercial efficiency.

We wish E.D.A. in its new work every success, and in doing so we appeal again for the ungrudging support of all those who undoubtedly will benefit by its efforts, and at the same time we take the opportunity to couple our own efforts with those of the Association, on the ground that the objects in both cases are identical, and to ask for support in our own work.

A New Weir Report.

We refer on a later page to the setting up by the Government of a committee to report on the electrification of the railways—particularly the main lines—of Great Britain. The present inquiry is a logical outcome of the creation of the Central Electricity Board, one of whose duties is to render electrical energy more generally available, since the construction of a high-voltage network will be a very considerable help towards making main-line electrification an economic possibility. It is fitting, therefore, that Lord Weir of Eastwood should have been asked to continue his work by presiding over the present committee.

Electrical engineers will be able to regard the result of this committee's deliberations from a more objective standpoint than they were able to adopt towards those of its predecessor, when a natural and proper solicitude for individual aspects often caused the larger issues to become obscured. They will now be chiefly interested in the possibilities inherent in a potential electrical consumption of seven thousand million kWh per annum, with a demand of two million kW, at an average load factor of 40 per cent. (Sir John Snell, ELEC. REV., August 13th, 1926, p. 274.)

They will also entertain the hope that the increased user of the national transmission system thereby occasioned will result in some reduction in the cost of electricity supplied by the Board.

If legislation is found necessary, we may hope that it will follow the publication of the second Weir Committee's report as swiftly as it did that of the first Weir Committee in 1926.

The Minister of Transport has allayed in advance one possible qualm we might otherwise have suffered, as, in an explanatory memorandum, he states that the appointment of the committee will in no way interfere with or delay schemes of electrification now under consideration.

In view of the Government's commitments towards alleviating unemployment, we imagine that there need be no fear of legislative delays, and that the existing proposals for railway electrification will, if at all possible, be expedited. It is possible that the conversations reported between Mr. J. H. Thomas and Sir Henry Thornton in Canada are not without some bearing on railway electrification in this country.

The Public Lighting Engineers' Conference.

THIS week the sixth annual conference of the Association of Public Lighting Engineers took place at Bournemouth; a report of the proceedings commences in this issue. In his brief address, which is abstracted in this issue, the new president, Mr. S. B. Langlands, J.P. (Lighting Inspector, Glasgow), made reference to the growing strength of the Association and its acceptance as a representative body by the British Engineering Standards Association and the International Illumination Commission. There is no doubt of the importance of the Association's sphere and still less doubt of the scope for more and better street lighting.

It is the Association's principal object to ensure that all developments in this direction are carried out on sound and scientific lines, and the practical experience which it represents should give its pronouncements considerable weight.

An important part of the conference was the exhibition of street-lighting equipment which was arranged for the information of the members and the enlightenment of the public. The main features of the display are being described in our pages, and we also deal with one of the three papers which were read.

Good News from Argentina.

THE news (recorded in our "Business Notes") that the British Economic Mission to Argentina and Brazil has practically concluded a satisfactory trade agreement with the Argentine Government gives us particular gratification, as we have consistently, over a very long period, advocated the strengthening of trade relationship with the great Latin-American Republics.

These early first fruits of the Commission's labours should silence some of the criticism which has been raised—particularly among the British in Argentina itself. The attitude there appears to be that British merchants in the Republic are already doing all that can be done to foster British trade with Argentina, and that it is ridiculous for any Government-appointed body to think that it can influence unalterable economic facts. Our usually sober contemporary, the *Review of the River Plate*, recently dismissed the Mission in the following terms:—"Quite frankly, to talk of searching for new markets in either Argentina or Brazil is to talk nonsense; and neither nonsense nor flapdoodle is what the situation either calls for or can stand."

On the other hand, the Mission appears to have caused a certain amount of perturbation in the United States, where it is viewed as a definite challenge to the growth of American influence in South America.

We have been persistent in our belief that the South American markets still hold possibilities for British manufacturers and merchants, and we feel that our faith is being, and will be, justified by the results accruing from the Mission's tour.

Railway Electrification in France.

Synopsis of a lecture recently delivered before an engineering conference at the Conservatoire des Arts et Métiers in Paris, France.

By H. PARODI.*

THE utilisation of national resources for the production of energy in the form of electricity is one of the principal objects of post-war activity in France. While the electrification of railways may be considered to be a pivot on which this activity has turned, the whole question has been still more closely associated with the generation of power for the industrial requirements of the nation.

Fig. 1.—Coindre Hydro-Electric Generating Station.

Before the 1914-18 European war electric railways in France were quite local and very restricted in their influence. Public powers, and even the exploiters of railways, evinced a certain scepticism for a new method of traction which presented so many aspects, none of which seemed to be conclusive. Consequently the substitution of electricity for steam appeared to be desirable only in special cases and under particular conditions, such as for underground railways, for local and dense traffic, and for mountainous lines over heavy gradients. Some of these conditions applied particularly to the underground Métropolitain and Nord-Sud railways in Paris, which commenced operation some time after the short stretch of underground line between the Quai d'Orsay and Austerlitz at the head of the system belonging to the Cie du Chemin de Fer d'Orléans.

It was in 1911, indeed, and in the United States, that the first example of electrification embracing the whole of a suburban service, including the transport of passengers and goods on an important line, but of short length (New York-New Haven-Hartford), was put into operation. In Italy very important electrification work has been done between Modane and Turin, between Geneva and Ronco, and on all the lines in the neighbourhood of Geneva, which has demonstrated conclusively the exceptional qualities of a 3-phase system for heavy trains in mountainous districts, while, when an important movement of troops had to be effected on the Modane-Turin line after the battle of Caporretto, the services rendered by electric traction under war conditions were greatly appreciated. Several installations in France with high-voltage direct current on narrow-gauge lines, such as those from St. Georges de Commiers to La Mure, from Du Fayet to Chamonix, and Villefranche to Bourg-Madame, have also shown the advantages of electric traction for the working of mountainous lines.

During and after the war certain countries, such as Switzerland, realised the necessity, particularly in connection with the working of railways, of assuring their national independence from an economic point of view. Switzerland obtains all her coal from Germany, and frequently was deprived partially, and sometimes entirely, of the quantities necessary for her requirements, with the consequence that wood had to be substituted as fuel at the cost of a heavily reduced service. The need for a transformation of the system of traction became evident, and a programme was therefore elaborated which embodied the electrification of three-quarters of the Swiss railways on the single-phase $16\frac{2}{3}$-cycle system, fed by hydro-electric stations constructed by the railway itself. This problem, which the Swiss had resolved at least in principle, became general for practically all European countries, and everywhere it became apparent that it was necessary to develop national resources for the production of energy.

Coal Production and Consumption.

In the case of France the consumption of coal at present amounts to 80 million tons per year, whereas French mines produce barely 60 million. It is evident that the deficit of 20 million can be furnished satisfactorily and economically only by the employment of electricity generated by hydro-electric stations, in combination with thermal installations permitting the combustion of inferior fuel which it is not profitable to trans

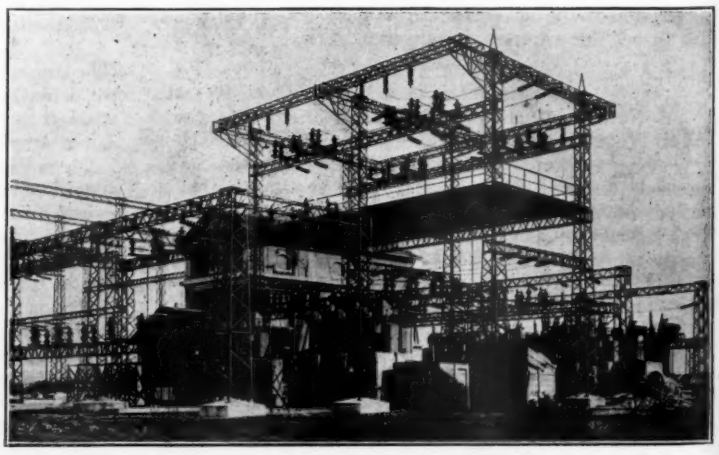


Fig. 2.—Eguzon Water-power Plant.

* Consulting engineer to the Cie. du Chemin de Fer d'Orléans and the Cie. du Chemin de Fer du Maroc. Translated and arranged by H. E. Drew.

port. In any case it is important to reduce, if not to abolish entirely, the tribute which France is obliged to pay to foreign countries, not only for the purchase of the annual 20 million tons of coal, but also for the two million hectolitres (about 45 million gallons) of petrol which is required for internal-combustion engines of all kinds.

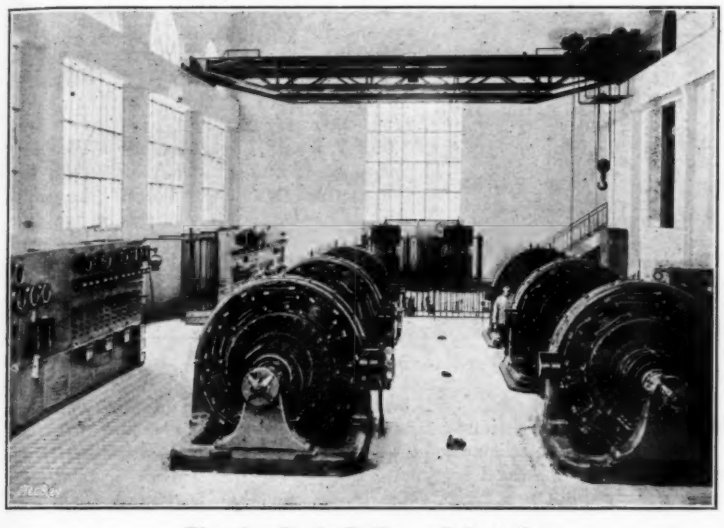


Fig. 3.—Paris Railway Sub-station.

It is, therefore, of interest to note that the capacity of generating stations in operation in France during 1927 amounted to 11½ billion kWh, or about half the amount produced in Germany. The figures for that year are as shown in Table I.

TABLE I.

	Thermal stations.	Hydraulic stations.	Total.
Installed power, kVA	4,624,000	1,719,000	6,343,000
Normal power available, kW	2,941,000	772,000	3,713,000
Energy produced, kWh	6,568,000,000	4,778,000,000	11,346,000,000
Utilisation of installed power, hours per year	1,420	2,780	—
Utilisation of normal power, available, hours per year ...	2,230	6,200	—

In the United States the amount is about seven times more for a population which is barely three times greater, and in Germany, Italy, and Switzerland the whole subject has been pursued on a much larger scale than in France.

Of the total of 11½ billion kWh, electric traction takes only about 150 millions, a proportion of 1.3 per cent. On the one hand it is easy to realise that this proportion can never be greatly increased, for although the conversion of the total of 40,000 km. of French railways to electric traction would effect an annual economy of 10 million tons of coal, that amount would represent hardly three or four billion kWh. On the other hand, before total electrification could be realised, even supposing that such an achievement will ever take place, the total consumption of energy in the country would have increased by five times. There is no reason to suppose that the quantity of energy absorbed by traction will ever vary greatly from the proportion now in vogue, which is about 12 per cent., the total amount of coal consumed by railways being 10 million tons, and the total consumption of the country being 80 million tons per year.

In view, then, of the relative unimportance of the maximum power consumption for traction purposes it may be asked why so much attention has been devoted to the electrification of French railways. The reply is that the French Government has thought it well to confine itself to the regularising of the general conditions for the distribution of electrical energy, and leaves to private initiative the conception and realisation of projects for its generation. Although in France there are certain regions, such as the Alps, where important systems of power distribution are in force, there are other districts where installations are sparse and cover vast areas. In order to develop those areas the public powers have used their authority to induce the railway companies to construct hydraulic stations and "lines of transportation," thus transforming the railway companies into generators and distributors of electricity. The wisdom of this policy, which tends to throw work on the railway companies which is outside their normal sphere of activity, is arguable, and up to the present opinion has been very much divided on the point.

The Cie. du Midi, however, has almost completely realised the conditions aimed at, by harnessing a large number of waterfalls in the Pyrenees, and by erecting high-voltage transmission lines which enable a large region to be supplied with power by the railway company. In other parts of the country similar powers have been investigated, even previously to the Cie. du Midi, but they have been only partially applied. It appears that the railway companies are not willing to assume, alone, the heavy capital expenditure which would be necessary for the generation and distribution of electricity on a large scale. In order to overcome this obstacle, various interests are being combined and inter-associated. Generally such combinations of interests are accepted, and even encouraged, by the Government, notwithstanding that it is

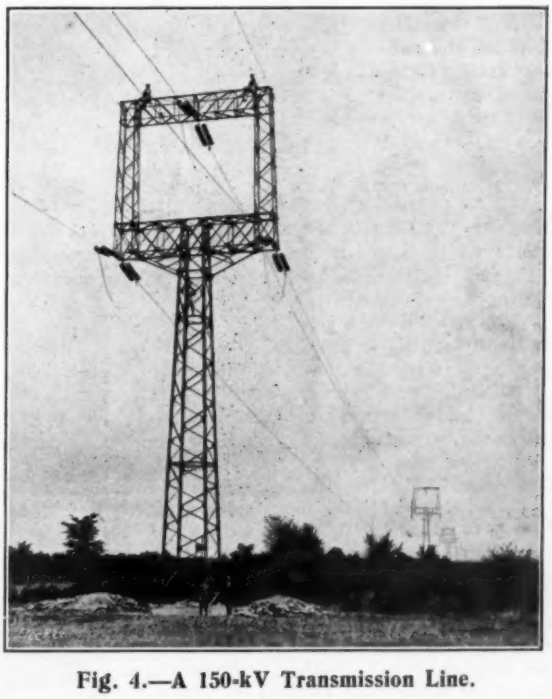


Fig. 4.—A 150-kV Transmission Line.

realised that later it may become necessary to limit their power by laws of an anti-trust character.

Direct Current Adopted in France.

These considerations have inevitably led to the adoption of direct current at high voltage as a uniform system for France, a choice which seems to be more and

more justified every day. In Germany, where this question has been investigated with the greatest care, the

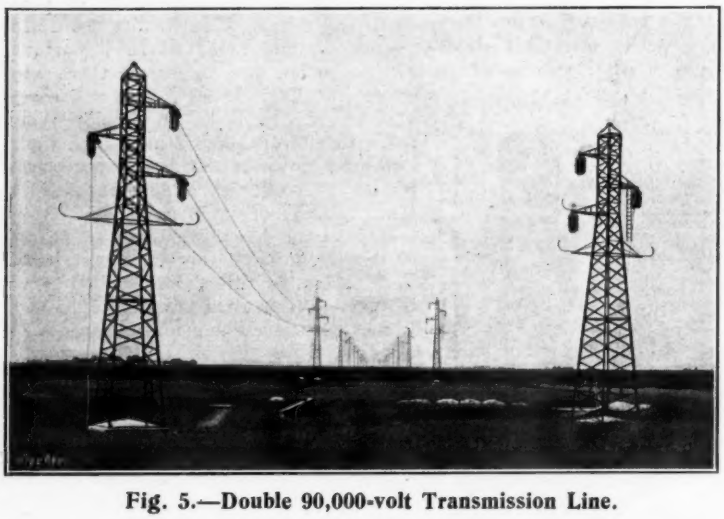


Fig. 5.—Double 90,000-volt Transmission Line.

electrification of railways and the electrification of the country for industrial purposes have been kept quite distinct, and other nations which have been subjected to German influence, such as Switzerland, Austria, Sweden, and Norway, have adopted her programme and chosen single-phase at $16\frac{2}{3}$ cycles as a uniform system for traction. It is curious to note, however, that it is in those countries in which the railways belong to the State, or are subject to State control, that the problem of electrification has been solved independently, at least in appearance, of industrial needs. Now that it is possible to regard the subject in its entirety it may well be asked if the French railway companies have obtained, or will obtain, the profit which they are justified in expecting as a return for the initiative which they have evinced in the public interest.

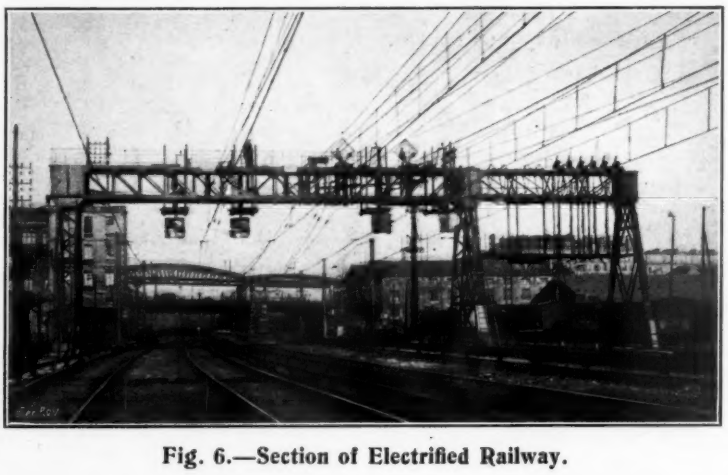


Fig. 6.—Section of Electrified Railway.

In Sweden and Norway, where a part of the railway systems has been electrified, the transmission of energy is effected on the 3-phase, 50-cycle system, transformed to single-phase at $16\frac{2}{3}$ cycles frequency for the purposes of traction. In the United States a type of installation is being developed which employs single-phase at 25 cycles frequency, which system is also employed in France, particularly on the Mediterranean littoral and throughout about ten departments. Table II shows the length of lines and systems in operation throughout Europe in 1927. Thus, in Europe, 75 per cent. of the railways worked electrically are operated by alternating current, and only 24.7 per cent. by direct current. These figures demonstrate particularly that the employment of direct current increases in value as the traffic becomes more dense, which fact may indeed be easily understood when it is remembered that the installation of contact lines and sub-stations is much more costly in the case of a direct-current system than in that of a single-phase system, and therefore assumes less importance as the traffic is more dense. For local lines, such as the Ouest-Etat, electrification at from 600 to 700 V is warranted; on the Paris-Orléans heavy traffic system the pressure of 1,500 V is quite suitable; on lines relatively weak in traffic, such as those from Brive to Toulouse, from Bordeaux to Irun, and from Dax to Toulouse, a pressure of 3,000 V would have been more efficient. In general, one may say that the less the traffic the more should the voltage be raised, for which reason the railways constructed in Morocco for electric traction from the beginning have been well advised in adopting 3,000 V.

Table II does not include figures of American railways, but it may be said that the results obtained in America are identical with those obtained in Europe, and that all the electrification work which attracts consideration, such as the schemes of the New York-New Haven-Hartford, Norfolk and Western, and the Virginia railways, have been carried out on the single-phase 25-cycle system. Direct current has been applied only in the case of local lines, such as those at New York and Chicago, and on trunk lines with relatively weak traffic, such as the Chicago, Milwaukee and St. Paul. It may also be observed that the electrification of the local traffic lines in Philadelphia on the single-phase, 11,000-V, 25-cycle system is at least as attractive as that of the New York Central direct-current 600-V system.

[The comparative figures referred to on this page

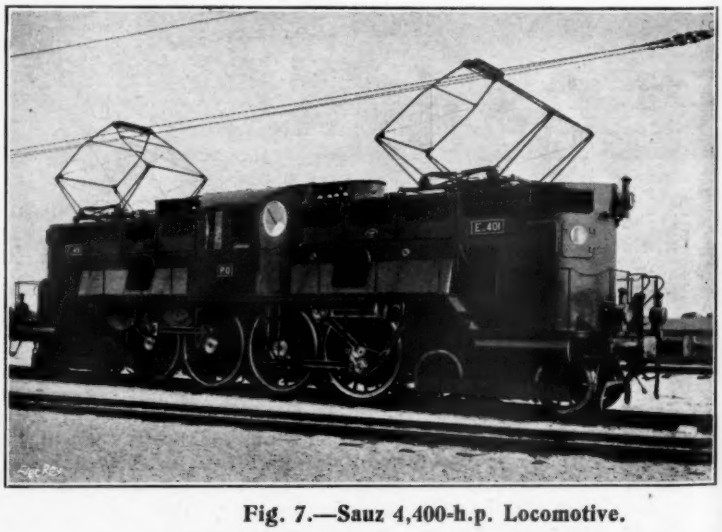


Fig. 7.—Sauz 4,400-h.p. Locomotive.

will be found in Table II on the following page 427, in the first column.]

Electricity *versus* Steam.

As regards the systems available for electric traction, the outstanding feature is the wide choice which may be had. All systems, without exception, have given satisfaction from a technical point of view, and, as a matter of fact, the diversity of choice is harmful to electric traction, for the resulting discussions between the technicians on their respective merits have tended rather to encourage the continuance of steam. Now, however, with important installations in existence, it may be stated that the variety of systems is but a proof of the flexibility of electric traction, and that from the technical point of view the substitution of electricity for steam is always advantageous.

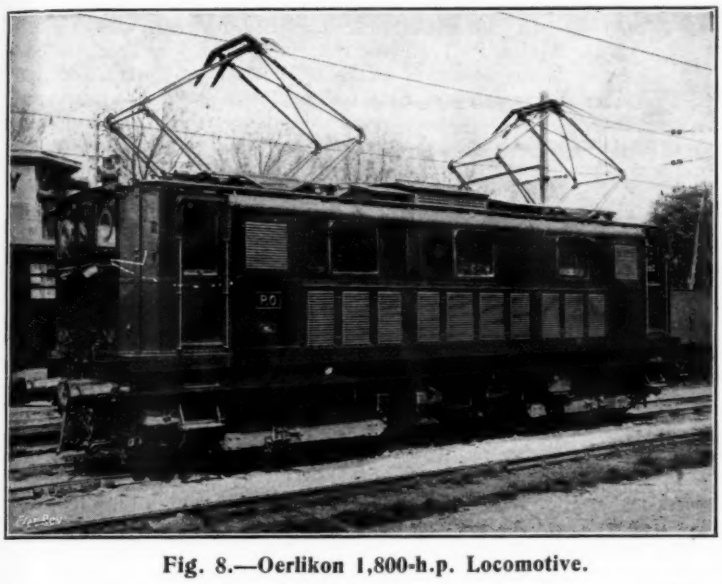


Fig. 8.—Oerlikon 1,800-h.p. Locomotive.

Can the same thing be said of the economic results? The reply in this case is less evident and is rendered more difficult on account of the heavy expenditure which is necessary to convert a line in full exploitation, as such work may necessitate an increase of from 20 to 30 per cent. in capital. In every electrification undertaking a whole series of expenses has to be accepted which would have been avoided if the electrical installation had been provided when the line was originally constructed, as in the case of a tramway or an underground railway.

TABLE II.

	Single phase	3-phase	Direct current	Total
Length of line electrified, km.	4,361	1,222	1,843	7,426
	58.6	16.7%	24.7%	100%
Consumption of energy in millions of kWh (h.p.)	740	270	447	1,457
	50.7	18.6%	30.7%	100%
Consumption of energy in kWh (h.p.) per km. per year ...	169,000	220,000	243,000	632,000

However this may be, the experience which is now available allows it to be said that with interest at from 6 to 7 per cent. the electrical transformation of lines carrying heavy traffic, or, more precisely, having a heavy consumption of coal, is a sound financial operation. The case of railways with but weak traffic is certainly different, and on some lines the cost of electrification, calculated with exactitude, may result in annual financial charges which may exceed the receipts from the exploitation.

The problem is therefore for the public authorities to determine beforehand which system may be adopted at the least cost, and afterwards on which lines electrical installation would be attractive, either by reason of the traffic or of the local conditions governing the production and transmission of energy.

In making a technical comparison between electricity and steam it is thought that the best basis on which to define traffic is the annual consumption of coal per kilometre. For the whole of a railway system, such as that of the Cie. d'Orléans, the average consumption of fuel per ton-km. hauled is 70 grammes, which corresponds with useful work of less than 5,000 kilogramme-metres. Admitting this exaggerated estimate, the average return for steam traction does not exceed 2.5 per cent. On account of the absence of condensation, the relatively low pressure employed, and the heavy losses by radiation and conductibility, the steam locomotive as a machine gives a very poor return: even in laboratories where cooling due to rapid circulation of air is suppressed, there is barely a return of 10 or 12 per cent. at the tires of the driving wheels, and if allowance is made for the traction of the engine and tender, it is easy to realise that the power return cannot exceed 2.5 per cent. per ton hauled.

The conversion to electric traction of the whole of a large railway system previously worked by steam not having been effected anywhere, it is impossible to produce average statistics of the corresponding amount of electrical energy; but by deducting the coefficient employed in the electrification work on the Paris and Orléans lines, which experience has shown to be correct, it is possible to calculate the amount of high-voltage energy, which, for the whole of this system, is about 27 watt-hours per ton hauled per kilometre. The utilisation of a kWh (high-voltage) renders possible an average economy of from 2.5 to 2.6 kg. of coal, although this figure, which has resulted from experience on the Paris-Vierzon section, cannot be stated to be official.

A series of calculations, which it is not necessary to reproduce, has shown that electrification, as a financial operation, is the more likely to be successful and advantageous as the traffic is more important. In general, it is wrong to consider that only railways over heavy gradients merit electrification; it is certain that on mountain lines the return given by steam working is more unsatisfactory than on the level, but the profit to be realised can only attain to importance when the difficult route has, or may obtain, an important quantity of traffic. The conversion of a railway system to electric traction is a lengthy operation, and the results

Fig. 9.—Interior of Motor Passenger Coach.

from an economic point of view must be judged, not from the beginning, but from the period when the system is working at its fullest capacity. Thanks to the improved financial conditions now existing in France, it may be said that the success obtained from a technical standpoint has exceeded all hopes, and that from the financial aspect it is now possible to convert a situation which at one time appeared to be extremely unfavourable to one which will give the whole of the return originally anticipated.

Suburban Passenger and Goods Traffic.

During recent years the Paris suburban passenger traffic has continually increased, and the approximate number of passengers dealt with at the principal metropolitan stations is shown in the following table:—

	Suburban lines.	Main lines.	Total.
Saint Lazare	285,000	15,000	300,000
Nord	236,000	128,000	364,000
Est	100,000	180,000	280,000
Paris-Lyons-Meditérranean ...	75,000	90,000	165,000
Paris-Orléans	80,000	46,000	126,000
	776,000	459,000	1,235,000

In consequence of this development it has become necessary to increase the trains both in number and in weight, and in this respect the section Paris-Orléans-Vierzon is particularly interesting from a technical point of view, because it constitutes the first example of the electrification of a suburban service, including both passengers and goods, over a considerable length of line with heavy traffic. It may be that the methods by which this work has been carried out are not the best, but at least they have given proof of perfect regularity and security, as well as of an excellent return economically, the consumption of high tension energy barely reaching 22 W-hr. per ton-km. hauled. The same type of locomotive is employed for both passenger and goods trains, with the difference that the driving motors are coupled in series for goods trains and in parallel for passengers. The power exerted is sufficient to haul trains of 350/400 tons at 100 km. per hour. A double locomotive, formed by coupling, electrically and mechanically, two locomotives each of 75 tons, has an adherence of 150 tons, gives 1,800/2,000 h.p. when coupled in series, and 3,600/4,000 h.p. when in parallel, and should be sufficient for all requirements of the Paris-Toulouse line where 2,000-ton trains are drawn at 20/45 km. per hour over 1 per cent. gradients. The results given by these locomotives have surpassed all expectations, and in operation their work may be compared favourably in every respect with the achievements realised by the most powerful steam locomotive of the Pacific type previously employed by the Cie. d'Orléans. For high speeds it has been shown that the electric locomotive of the 2D2 type with four motor-driven axles, giving, under 1-hour rating, 3,600/4,000 h.p., are capable of hauling 800-ton trains at 105/110 km. per hour, and that heavy passenger trains may be operated by them without difficulty at 120/130 km. per hour. Several of these locomotives each work over a distance of 19,000 km. in the course of a month, and during their regular service since 1927 have travelled over distances exceeding 400,000 km.

Large projects of electrification have been investigated by the four railway systems known as the Etat, Midi, P.L.M., and Paris-Orléans, and those portions of the projects which have been put into execution consume yearly 50 million kWh for the Etat, 80 millions for the Midi, and 110 millions for the P.O. The P.L.M. is pursuing its preliminary trials on the line from Culoz to Modane. The electrification work effected by the Etat includes practically the whole of the suburban lines leaving the St. Lazare terminus and the Invalides; the Midi embraces the main lines from Bordeaux to Irun and Dax to Toulouse, with the branch lines leading to the Pyrenées; as shown, the Orléans works its heavy traffic of passengers and goods from Paris to Orléans and Vierzon, and the total of this electrification work covers about 2,500 km. of single line. To this total in France must be added 225 km. equipped in Morocco at 3,000 V d.c., and 300 km. now being electrified in Morocco and Algeria. This work in northern Africa is particularly interesting in view of the facts that neither coal nor water exist in sufficient quantity, or are suitably distributed, for the establishment and working of steam-driven trains.

In view of the results obtained in France and northern Africa it is evident that the question to be considered is the extension of the application of electric traction. The efficiency of the technical aspects may be considered to have been demonstrated completely, both in France and abroad; therefore the outstanding question concerns finance entirely and varies according to circumstances. The possibilities offered by electricity for traction over immense distances should be investigated without fear or favour, and should then be adopted in the best public interest without seeking to apply any particular system which may have been proved to be excellent in one case, but may be unsuitable in another. The fact that we have developed in France and northern Africa installations operated with d.c. at 750 V, 1,500 V, and 3,000 V as successfully as the Swiss and Germans have developed the single-phase system, or as successfully as the Italians have adopted the three-phase system, should incite us to reflect and to avoid the waste of time and money which would result from the adoption of systems developed *a priori* by organisations which, only too often, are incompetent, prejudiced, and influenced financially.

The accompanying illustrations show plant of the Chemin de fer d'Orleans. Fig. 1 presents a view of the Coindre hydro-electric station, which will operate under a fall of 120 m. and have an annual capacity of 90 million kWh; three 7,500-kW, 90,000-volt machines are being installed. Fig. 2 is a view of the hydro-electric station at Eguzon on the Creuse River; the height of the fall is 60 m., and the annual capacity 120 million kWh, three 11,000-kW generators being in use.

Fig. 3 shows a Paris sub-station, each 1,000-kW group of three convertors working at 750 volts in series. In the background two mercury-arc rectifiers can be seen of 500 kW at 600 volts. Fig. 4 is a view of the 150/90-kV transmission line feeding Eguzon, Orleans, and Paris. Fig. 5 shows two 90-kV lines transmitting power from Eguzon to Paris (300 km.) and feeding nine sub-stations, which transform to 1,500 volts.

Fig. 6 illustrates part of the Paris-Toulouse railway line, the total length of line electrically equipped being 1,000 km.; there are four pairs of rails from Paris to Etampes, two pairs from Etampes to Vierzon, and two from Bretigny to Dourdan. Fig. 7 shows a Sauz type 2D2 locomotive of 4,400 h.p. at the one-hour rating (4,000 h.p. continuous), while fig. 8 shows an Oerlikon locomotive of 1,800 h.p. at the one-hour rating (1,500 h.p. continuous), driven by four 1,500-volt motors; its weight is 75 tons. Fig. 9 is an interior view of one 80-passenger coach in service between Paris and Dourdon (Paris-Toulouse line); it is self-propelled by four motors, each of 175 h.p. at 1,500 volts; pneumatic control; weight 65 tons.

Extension of the Hudson Avenue Station.

The capacity of the Brooklyn Edison Co.'s Hudson Avenue power station is to be raised to 450,000 kW by the installation of a 110,000-kW generating unit consisting of a cross-compound steam turbine, condensing equipment, and generator. The set has been ordered from the Westinghouse Electric and Manufacturing Co. This will be the fifth unit to be installed in the station. The station is designed for eight sets with a total capacity of more than a million h.p. The total cost of the set, including all auxiliaries, will be about $7,000,000.

Unappreciated Economies of High Voltage.

An attempt to take proper cognisance of the effect of "earth drop" and internal drop, per kW transmitted, when comparing the relative advantages of electric power transmission at high and low voltages.

By MAJOR A. M. TAYLOR, M.I.E.E., M.Amer.I.E.E.

IN the following paragraph, as well as in the penultimate paragraph but one of the present article, will be found the author's reasons for heading this article "*Un*appreciated Economics, &c."

If a company engineer or a municipal engineer is asked whether there is any substantial gain in using higher pressures and where it comes in, he will work out the cable voltage drops on his own system, and, if he finds these quite negligible, he will probably say that there is no need whatever for higher voltage. But, if so, he will be quite wrong; and the larger his system, the greater the error.

If it is represented to him that "if you quadruple the voltage you are enabled to use one quarter of the number of cables for transmitting a given power (and still quarter the loss)," he will answer at once: "Oh, but you can't get the advantage of the higher voltage, because of the much higher thermal resistance." This would be considered quite a suitable reply.

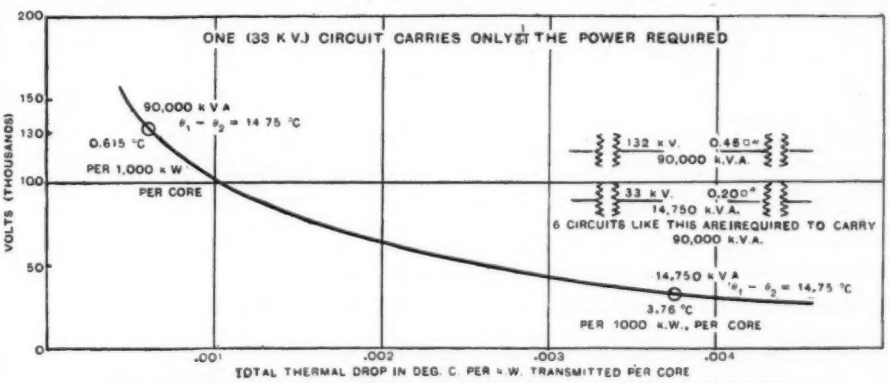


Fig. 1.—Comparison of Cable Loading for Equal Thermal Drops (different cross sections).

The object of the present article is to show *that this is not the case* and that the savings in street space and in lost energy are *very much greater* than engineers, in general, realise, except a few specialists who are mostly among the ranks of the cable manufacturers. In addition, as will appear later, a certain amount of (quite unintentional) "juggling" is done with the question of thermal drops in the ground itself, which obscures the issue and leads to wrong conclusions. It is the object of this article to point this out also and to take account of such drops in a suitable manner.

In order to simplify the questions at issue, the writer will consider merely the case as between 33-kV and 132-kV cables, and will compare one of the latest 33-kV cables with the pressure-oil-filled 132-kV cable employed at New York (Pirelli). He will, also further to simplify the issue, assume a single-core cable all by itself, this being, however, decidedly unfair to the 132-kV system (as will be seen).

Three sets of curves are here presented. In fig. 3 a single 3-phase, 90,000-kVA, 132-kV, 0.46 sq. in. transmission has had its thermal constants worked out, and is compared with a single 3-phase, 14,750-kVA, 33-kV, 0.20-sq. in. transmission, and it will be realised that there is hardly any difference between the thermal resistance of the 132-kV cable and that of the 33-kV cable; in fact, when the "ground" thermal resistance is also taken account of, the (total) thermal resistance of the 132-kV cable is actually *less* than that of the 33-kV cable.

In order to focus attention on this point, the author has traced (dotted) a curve CD^1 which, he feels confident, would have been suggested by the vast majority of engineers as representing their idea of the way in which the thermal resistance varied, and has labelled the point D on the true curve and the corresponding point D^1 on the imaginary curve. Even this curve CD does an injustice to the 132-kV cable, in that in a 3-phase installation, the grouping together of the three conductors results in the thermal drop in the ground, in relation to that inside the cable, being (substantially) trebled; equivalent, in fact, to displacing the curve CD considerably further to the right and causing the lower part of it to

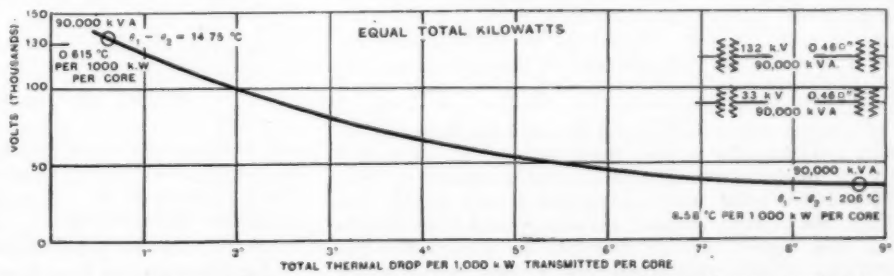


Fig. 2.—Comparison of Thermal Drops for Equal Cable Loading (equal cross sections).

curve away still more to the right, carrying the point D along with it (see extreme right-hand curve). This, however, is ignored in the calculations which follow, which therefore quite materially favour the 33,000-volt cable.

	Thl. Drop.
In fig. 1: A 90,000-kVA, 132-kV, 0.46-sq. in. transmission	14.75° C.
A 14,750-kVA, 33-kV, 0.20-sq. in. transmission	14.75° C.

(but six circuits are required to transmit 90,000 kVA). The advantage gained by the use of the higher voltage depends also on the reduced percentage losses; these are not taken account of in fig. 1, which shows primarily the temperature conditions when the one circuit carries 90,000 kVA and the other carries 14,750 kVA.

	Thl. Drop.
In fig. 2: A 90,000-kVA, 132-kV, 0.46-sq. in. transmission	14.75° C.
A 90,000-kVA, 33-kV, 0.46-sq.in. transmission	206° C.

In this figure things are put on the basis of a *single circuit*, the copper in the single 33,000-V circuit being stiffened up to equality with that of the 132,000-V circuit; the current is pushed up, regardless of temperature, so as to bring the whole transmission into the conditions of a single circuit. This enables us to take account of *street space* occupied—a very important factor.

Of course, the *thermal* drop indicated is quite out of the question, but the relative advantages of the two transmission systems are not thereby obscured, and the argument is rendered easier to follow by the ordinary engineer.

Summing up, we may say that, from fig. 2, for equal kilowatts, equal street interference, and equal copper the temperature rise is as 1.0 : 14.0 (nearly).

It is also deducible that for equal temperature rise, equal street interference, and equal copper, the power transmitted is as 3.74 : 1.00.

Results Applied to London.

Assume that in London alone there are 2,000 miles of 3-core 0.25 sq. in. cable (average figures for all voltages). During the next six years the power output will be doubled, and during 12 years it will be quadrupled, giving a total length of cable of 8,000 miles by the end. It may, of course, be objected that the expenditure is not proportional to the kW; but, even if the figures considered below were halved, they would be sufficiently serious.

It can be shown that, in the case that has been worked out, reducing the powers from 90,000 kVA to 34,000 kVA,* to get down to a reasonable temperature drop with 33-kV cable, and taking lost energy at ¼d. per kWh, the average value of the energy saved by employing the higher voltage amounts to £1,180,000 per annum, which—capitalised at 5 per cent.—would amount to £23,600,000.

Reducing to terms of 0.25-sq. in. cable, to agree with the first assumption, this would become roughly £11,800,000 for London alone. For the whole of Great Britain it might amount to, say, £47,000,000. The above is based on a 30 per cent. load factor, but 40 per cent. would give considerably more saving, and certain cables will be working at 56 to 60 per cent. load factor.

The importance of this question of voltage arises from the fact that we have, in the transformer, apparatus which can be designed with perfect safety to quadruple the ratio of transformation, while still keeping to the consumers' existing voltages; while, as regards the cables and switchgear, the voltage can be raised from 5,000 to 20,000 V with perfect safety and reliability.

The advantage of reducing the number of cables traversing the London streets to, roughly, one-quarter is surely, of itself, worth the most serious consideration, even were *no* pecuniary advantages consequent in its train. How much more so when an exceedingly large saving, of the order of many millions, may be effected? (It has been impossible, owing to considerations of space, to give the detailed workings for all the final results given, but the author will welcome correspondence on the subject and be pleased to give further particulars, as he has opportunity.)

Importance of Ground Drop.

So far as the author is aware, this is the first published attempt to take proper cognisance of the effect of " earth drop " when weighing up the relative advantages of high- and low-voltage transmission. The advocates of lower-voltage transmission, when they find they cannot possibly put through a single circuit what they require, tacitly assume that the case is sufficiently met by running more circuits in parallel. They thereby secure the benefits of a large number of parallel (thermal) earth resistances, and so reduce the effective value of the " network" of earth resistances to $1/n$th value, and so get over the very serious " drop " in the ground with the lower voltages. But this is only done at the expense of n times the interference with the street area and is a disadvantage debitable to low-voltage transmission. Put in another way, low-voltage transmission wastes n times the total amount of heat in the conductors, and requires n times the provision of dissipating means that high-voltage transmission requires. It is, however, a mistake to deliver 1,000 kWh hourly into the ground, when 100 kWh would suffice! It may be useful in preventing water pipes freezing, but that is hardly the function of an electricity supply system.

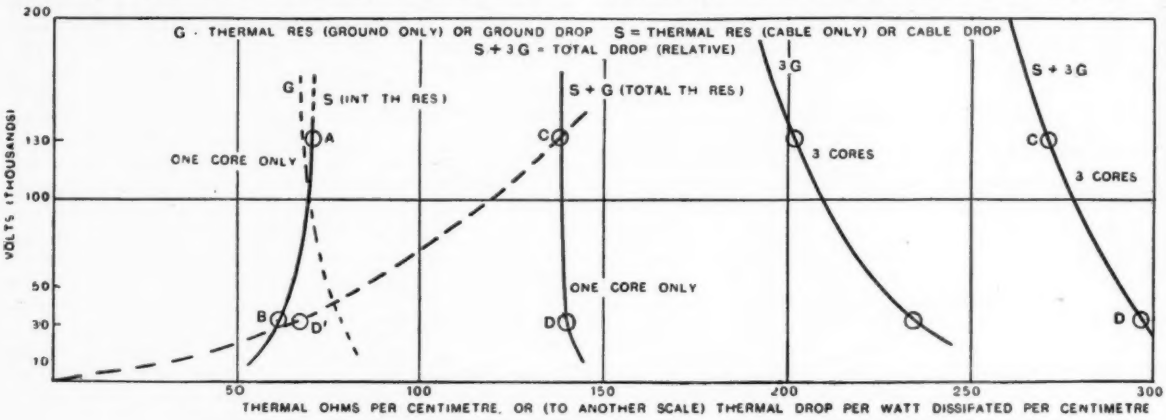


Fig. 3.—Comparison of Thermal Resistances of 132-kV and 33-kV Cables.

Another View of Savings Effected.

Another way of looking at the results obtained is that the waste energy *saved* by employing the higher voltage would pay for the replacing of the cable by a new one every 15 years or so. In other words, it would pay for *perpetual* maintenance.

An Unconsidered Saving.

Another matter of importance should have been pointed out, *viz.*, that in the present comparison cognisance has not been taken of the very considerable reduction in carrying capacity when lower voltages are employed, and consequently more cables are used in parallel, due to the proximity of other cables carrying load. In some cases this reduction is of the order of 33 per cent., and even more, especially where there are ducts buried at a considerable depth.

* The temperature drop in the 132-kV cable at this load is only 2.1° C.

Thermal Storage Water Heaters.

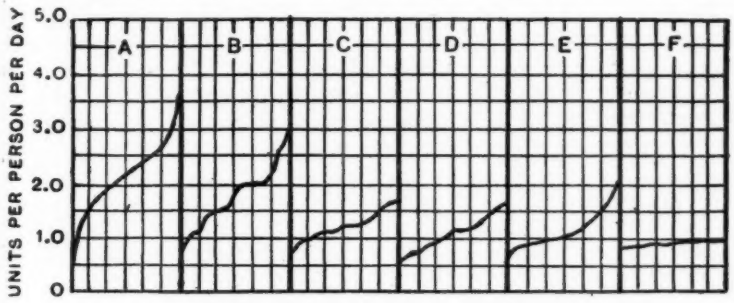
Notes on energy consumption for water heating in the home.

By L. G. A. SIMS, M.Sc. (Eng.)

THE lack of published information concerning the running costs of off-peak water-heating apparatus has probably hindered the widespread adoption in this country of that form of thermal storage load. In any case there is at present a reluctance on the part of many supply engineers to introduce low off-peak tariffs and it is difficult to see any other valid explanation. I believe, and have previously endeavoured to show, that, even with coal-fired stations, thermal storage can be made a commercial success. Other writers have published figures which point the same way, and it would seem, therefore, that the real difficulty is to decide definitely what the tariff shall be.

This view is strengthened by the fact that certain supply authorities, so far unwilling to introduce an off-peak tariff, are running isolated heaters on which they are making observations with the idea of considering a tariff later on, when sufficient results have been collected.

But the significance of any practical method of storing electrical energy, even though it be stored as heat, is surely so great that it should not be treated in any indifferent manner, but should be welcomed enthusiastically. Moreover, the results given by tests on single heaters may be insufficient as a basis of judgment. If figures of energy consumption are to be trustworthy they must be taken over a considerable period of time, and from a large number of examples. Such figures, although not published up to the present in the British Press, have recently appeared in Swiss technical literature.[1] Their author, Dipl. Ing. O. Locher-Jucker, has kindly agreed to allow the translation and republication of certain of the figures and curves in conjunction with the results of various observations I have made independently on different examples. I hope that their publication in the British technical Press will forward a wider introduction of off-peak tariffs, and I submit them as a supplement to previous articles in this journal in advocacy of the principle of thermal storage.[2 3].



Curve A. Families of 2 persons. [Results from 27 families.]
Curve B. Families of 3 persons. [Results from 22 families].
Curve C. Families of 4 persons. [Results from 20 families.]
Curve D. Families of 5 persons. [Results from 12 families.]
Curve E. Families of 6 persons. [Results from 6 families.]
Curve F. Families of 7-9 persons. [Results from 5 families.]

Fig. 1.

Locher's observations were made upon about 90 families living in a colony of flats in Zurich, and in a colony of single houses, into which gas was not laid. Records were kept and results published for the thermal storage load and for the cooking load, but for the present purpose only the thermal storage results are now reproduced. The following details of the housing accommodation may be of interest. The flats had three to five rooms and were inhabited by people of the middle class, the rentals varying from about £48 10s. to £74 10s. per annum. The single houses were the property of the occupiers, the purchase prices varying from £1,200 to £2,000 each.[4]

Most of the heaters were of 22 gallons capacity and fed the bathroom and kitchen. They were controlled by a time switch, on an eight-hour loading. One time switch controlled all the water heaters in each set of flats. The size of the heater used, namely, 22 gallons, may, in my opinion, be taken as a suitable size for the average house in this country. I base this partly on experience in my own house where a 16½-gallon heater supplies the bathroom, and a separate 6½-gallon heater supplies the kitchen. This combination is satisfactory, but smaller sizes are not desirable unless used merely as auxiliaries.

Table I shows the results which Locher recorded for families varying in size from 2 persons to 7-9 persons each, and fig. 1 gives a graphical representation for a large number of families in this range, in terms of consumption in kWh per person per day. The abscissæ to the curves have no meaning other than that the families have been arranged in order of their consumption, the more thrifty ones being placed to the left.

Fig. 2 gives the averages of results taken from Table I. By expressing these results as in fig. 3 the average consumption per month of complete families, varying in size from 2 members upwards, may be observed. In fig. 4, I have expressed these results in a different form. The consumptions have been converted to terms of cost per family per month in English currency for various prices per unit. Any additional fixed charge, such as a percentage of the ratable value of the house, charge for time switch hire, &c., would, of course, have to be added to the figures given by these curves.

The results obtained by Locher are extremely interesting as well as of great practical value. In the first place, they apply to a sufficiently wide range of sizes of family to cover nearly all practical cases, and secondly, due to the extensive use of storage water heaters in Switzerland, the number of families, of each size, observed was large enough to make the average result trustworthy. That this is probably so will be shown by the independent examples which I quote later. It is important to notice the influence which an increasing size of family has upon levelling the consumption per head, as shown in fig. 1, and upon reducing it in a given family, fig. 2.

The question which can be raised in connection with these curves is this: "Would the average results shown in figs. 2, 3 and 4 be verified by independent observations made under an entirely different set of conditions and perhaps with different sizes or types of water heater?" It is in this connection that independent observations upon single families can be most valuable, for, although it can be seen from fig. 1 that it would be incorrect to advance such isolated tests as

TABLE I.

Persons per family.	Number of families.	Total number of persons.	Year's consumption in units.	Consumption per family per month.	Consumption per person per day. Average.	Min.	Max.
2	27	54	40,897	126	2.07	0.28	3.80
3	21	63	36,610	145	1.59	0.22	2.97
4	19	76	33,879	149	1.23	0.66	1.70
5	9	45	19,347	179	1.18	0.66	1.59
6	6	36	13,139	183	1.02	0.84	1.92
7-9	3	23	7,331	203	0.87	0.81	0.92
	85	297	151,203		1.39		

[1] "Beobachtungen über der Stromverbrauch in elektrischen Küchen von zwei Wohnkolonien in der Stadt Zürich." O. Locher, Dipl. Ing. Schweizerischen Wasserwirtschaft. No. 2.

[2] "The Domestic Storage of Energy." ELEC. REV., October 21st and 28th, November 4th, 1927.

[3] "The Off-peak Heating Load." ELEC. REV., March 1st and 9th, 1929.

[4] In this connection it should be mentioned that the prices of houses in Switzerland are higher than here. Tr.

giving reliable figures on which to base consumption estimates, yet in cases where the habits of single families are well known to the observer, these single observations can be employed as a check upon the validity of such general curves as those given by Mr. Locher, whose records were nearly all taken from heaters of the same size and manufacture. When this test is applied, as I have applied it below, I think it will be found that the averages are reliable. Naturally there will be exceptional cases, especially with small families.

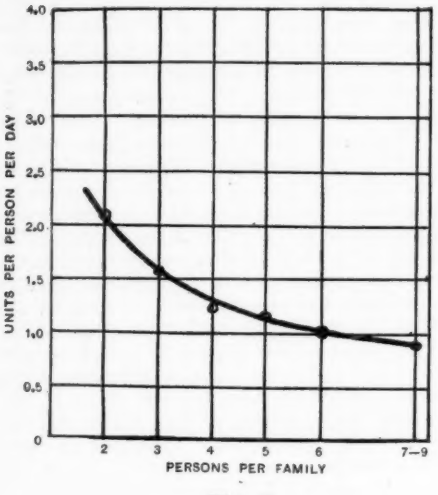


Fig. 2.

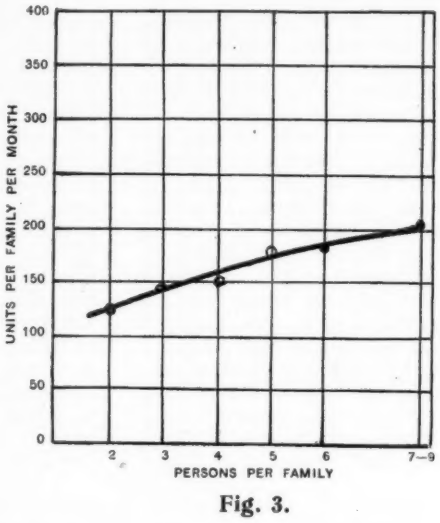


Fig. 3.

The following examples, recorded before Mr. Locher's results came under my notice, answer the question more definitely. Table II shows one year's consumption figures taken from the Supply Authority's official receipts, for a family of five people, consisting of two adults and three children using a floor-type storage heater of 41 gallons capacity. The heater feeds bathroom, kitchen, and one other point. The members of the family are

TABLE II.

Persons per family.	Consumption in units. 1st half of year.	2nd half of year.	Total.	Consumption of family per month.	Consumption per person per day.
5	1,060	1,045	2,105	174	1.16

One year's consumption of family of five people (two adults, three children), 41 gallon storage heater.

personal friends of the writer and constitute a thoroughly normal household, whose consumption might be expected, *a priori*, to provide a reliable average figure. It will be seen that the consumption per head per day is about 1.16 units, or for the whole family per month, about 176 units. If the figures for this case be taken from Locher's curves (figs. 2 and 3) we obtain about 1.2 units per person per day and about 175 units for the family per month. The agreement is therefore extremely close.

Table III shows the official consumption figures for a family of four people again known personally to the writer. The heater is a smaller one of 16½ gallons capacity. The family consists of two old people and two paying guests, the latter naturally being away from the household occasionally for short periods. This is

TABLE III.

Persons per family.	Consumption in units. 1st half of year.	2nd half of year.	Total.	Consumption of family per month.	Consumption per person per day.
4	910	833	1,743	145	1.2

One year's consumption of family of four people, all adults, 16½ gallon storage heater.

also a case which should be regarded as normal, though, if any adjustment were to be made, a figure somewhat below the average would be expected. It will be seen that the actual consumption of 1.2 units per person per day and 145 units for the family per month are in good agreement with, but a little below, the average figures predicted by the curves, which are 1.25 and 160, respectively. By reference to fig. 1, however, it is seen that the results come definitely in the central or average zone for families of four people.

Lastly, Table IV gives a summary of results for the first six months' experimental running of storage water-heating apparatus in my own house. This apparatus was installed with the intention of recording all aspects of its operation, for purposes of amassing general data on storage water heating. Advantage may be taken of this opportunity to make acknowledgment to the manufacturers, Messrs. Fr. Sauter, S.A., who offered to supply the heaters on exceptionally advantageous terms and to Mr. W. Lawson, M.I.E.E., of the Birmingham Electricity Department, who has kindly lent calibrated meters. The total capacity of the apparatus is 23 gallons, as mentioned previously in the text above. The six months taken form a fairly typical half year, dating from the end of January to the end of July, but cold weather probably predominated. The family is nominally of two people, but with a third as household help during certain intervals in the week.

I put this case forward as one which would necessarily be classified as that of a two-person family, whilst not being quite an average case, since there was extra help in the house (which presumably may make a noticeable difference in the consumption, the family being small), and because the period taken is the first half-year of the operation of the heaters. During this initial period there is a tendency towards extravagance. The novelty of having boiling-hot water available in bathroom and kitchen at all times is one that appeals very strongly to the women folk—a phase in the operation of water heaters which would always occur. How far do the Zurich curves cover a case of this sort? The recorded average consumption per person per day was 2.86 units, and for the family per month 174 units. Predictions from figs. 2 and 3 would give 2.1 units and 130 units, respectively. There is, therefore, in this

TABLE IV.

Persons per family.	Consumption in units. 1st half of year.	2nd half of year.	Total.	Consumption of family per month.	Consumption per person per day.
2	1,042			176	2.86

One half-year's consumption of family of two people (adults). Total storage heater capacity 23 gallons, made up of one heater of 16½ gallons and one of 6½ gallons.

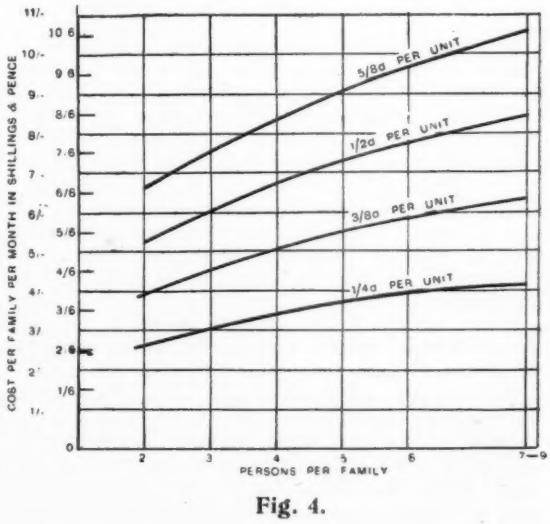


Fig. 4.

case an appreciable difference between the predicted and the actual results. At the same time it will be seen that the upper limit of consumption shown in fig. 1 amply covers the discrepancy. In general, I think it would be fair to say that, knowing the circumstances, a close estimate for this instance could have been made from fig. 2 in conjunction with an assumed adjustment based on fig. 1, but that the case of two-person families does call for some special care in estimating.

The general applicability of Locher's curves seems to me to be established by the test examples chosen. But the inception of a few off-peak water heating schemes in various parts of the country provides opportunities for further tests of the curves, and it would be interesting to hear other opinions, provided that the results employed have been carefully recorded over at least a typical half-year and that the general circumstances in which the heaters have been used are not abnormal.

In conclusion, I am glad to renew thanks to Dipl. Ing. O. Locher for allowing his results to be used in this way.

Author's Note.—Since writing the above I have noticed that an article on the same subject has appeared very recently in the German technical Press, as part of an account of a very comprehensive investigation, by two German engineers, of household consumption of electricity and gas for all purposes. The section which deals with the consumption of storage water heaters quotes results from 100 households in a German suburb and compares them with Locher's results from Zurich, which I have dealt with above. The agreement is very close, but the German figures are generally rather lower than the Swiss. This is attributed to a greater care in shortening the pipework in the German installations, pipe losses in storage lay-outs being very important. The results are a few per cent. lower for families of two persons, approaching and reaching agreement with the Swiss figures at the point corresponding to families of four persons and exceeding the Swiss figures for five-person families by a few per cent. Particular attention has been given in the German article to the water-heater consumption in the kitchen only, and a separate curve of averages is given for it. According to this the kitchen consumption is about 36 per cent. of the total for families of all sizes. One interesting statement is that when the kitchen has an electric cooker there is a decrease of 50 per cent. of the storage heater consumption when the hot plates are used for boiling water. This is due partly to the economical practice of utilising the " after heat " of the hot-plates on the one hand, and partly to the freer use of hot water when there is a storage heater available, on the other. But, although this is the case, the costs are not very different, due to the cheap night tariff on which the heater is charged. It is wisely stated that the totally different " level of existence " which the housewife enjoys when her kitchen is equipped with a storage heater must not be forgotten.

The complete article appears in two parts in " Elektrizitätswirtschaft," Nos. 480 and 486, published in Berlin. (" Vergleichsgrundlagen für den Electrizitäts—und Gasverbrauch im Haushalt," H. F. Mueller and F. Mörtzsch.) A reprint is available from the publishers.

The British Association.—IV.

A general account of the meeting of the British Association for the Advancement of Science at Johannesburg, South Africa.

By OUR SPECIAL COMMISSIONER.

OWING to their large number the delegates were divided into two parties, one of which reached Kimberley on Monday, July 29th, and the other on the following day. The journey from Cape Town through the Hex River district can vie with almost any mountain railway on account of the grandeur of its scenery. The line is a triumph of engineering skill, and in spite of the 3 ft. 6 in. gauge, the carriages are convenient and the running smooth. The directors of the de Beers Consolidated diamond mines were the hosts of the Association at Kimberley. The party visited first the plant where the blue rock containing the diamonds is crushed. The heavier rock containing the diamonds is run over pulsators, where the diamond bearing portion is separated by gravitation, and finally passes over a greased sheet covered with vaseline to which the diamonds adhere. It is only diamonds from freshly crushed rock that can be collected in this way; the alluvial diamonds, such as have been found recently in Namaqualand, become covered with a thin layer of oxidised matter which prevents their sticking to the vaseline. All the machinery is electrically operated, the power being obtained from a central station containing over 20,000 kilowatts of plant. The turbines run at 3,000 r.p.m. and are supplied with steam at 200 lb. pressure, and there are no features of very special interest. The energy is generated at 5,000 volts and transmitted by underground mains to the sub-station, where it is transformed to 200 volts. In distribution delta connection is used, and nearly all the motors are of the squirrel-cage type. The power factor, therefore, is low, and steps are being taken to install power-factor improving machinery. The load on the motors is, of course, very variable, especially on the mills used for crushing the rock.

The party was entertained at luncheon at Alexandersfontein, and afterwards visited the old Kimberley mine, which was the first in which diamonds were discovered. This is said to be the biggest hole ever dug in the earth. The maximum depth to which it was excavated was 3,500 feet, but it is now filled with water to within 900 feet of the surface. The working of the mine has now been discontinued owing to the expense of raising rock from so great a depth. One interesting feature about the diamond mines is the regularity of the diamond output: in one mine it is 32 carat per load and in another 19 carat, and so on, though the size of diamond obtained varies within wide limits. The first party encountered a characteristic South African sand storm, which blew all day on the Monday. At this altitude, 4,000 feet, the changes in temperature are very marked; it is very hot in the sun, but immediately after sunset the temperature falls very rapidly, often by as much as 20-30 deg. F. An excellent tramway service, supplied with direct current by rotary convertors from the central station, conveys all workers to the mines in the morning and brings them home at night. It has been found that iron poles corrode rapidly in some of the blue rock (containing iron sulphide), and the poles for supporting the overhead line are made of reinforced concrete. They are about 9 in. square at the base, tapering to a smaller section at the top, and present a very neat appearance.

On arrival in Johannesburg a welcome was given by the mayor. The first event of engineering interest was a lecture by Mr. F. E. Smith on the new airship R101. In the morning, on July 31st, Section G opened with a paper by Sir Chas. Parsons on recent progress in the design and construction of steam turbines and turbo-alternators. The paper described the new method that has been adopted for forging the large rotors of these machines, and the design of the alternators which had

enabled pressures up to 30,000 volts to be produced directly. The windings of these machines consist of a triple-concentric cable, the intermediate insulation between the conductors being micanite. By this means it is claimed that alternators giving this high pressure can be made as cheaply as those generating at 6,000 volts, and the losses in the transformers are saved. A description of this design has appeared recently in the *Journal* of the Institution of Electrical Engineers.* In the discussion Prof. Howe emphasised the advantage of the triple-concentric cable and the saving in insulation that could be brought about by subdividing the pressure between the successive layers. Prof. Marchant mentioned the economic advantage that could be obtained by a slight increase in efficiency, but laid stress on the advantage that could be obtained by having the high-tension side of the network in an oil insulated container such as a transformer.

Mr. Bernard Price gave an account of the system of compressed air supply which is given to the mines from the Rosherville and Robinson power stations. About 5,500 rock drills are employed daily on the Rand for drilling rock underground, of which one-third are supplied with compressed air from the centralised system. Compressed air is also used for operating hoists, pumps, drill-sharpening machines, and power hammers, for ventilating out-of-the-way places, for foundry work, and a variety of other services. Its chief advantages are: (1) its elasticity, (2) its property of absorbing heat from surrounding media, when doing work, and (3) its ventilating properties. The average consumption of compressed air per ton of ore milled is about 16 units, and the pressure of air supplied about 70 lb. per sq. in. Nearly half the load is within two miles, and 80 per cent. of the load is within three miles, of the nearest compressor station. The method of starting up the compressors in the Robinson station is of interest. They are driven by synchronous motors excited, when running, to take current at a leading power factor. They are run up by means of a motor-generator, the synchronous generator of which is driven by an asynchronous slip ring type motor, having water regulating resistances in the rotor circuit. While both machines are stationary, the a.c. generator is electrically connected to the compressor motor, and after each has been fully excited, the motor of the motor generator set is switched on. The two rotors then run up together until full speed is reached, when the compressor motor is synchronised on to the supply bus bars. To expedite the consecutive starting up of a number of motors, the motor-generator is brought to rest quickly by electrical braking. In the discussion Dr. J. H. Dobson asked whether the compressed air system was as economical as would be a system of air compressors at the mines, driven by electrical motors to which power was transmitted electrically, and other speakers asked questions about the technical details, to which Mr. Price replied. The last paper was one by Prof. Watermeyer and S. M. Hoffenburg, giving a *résumé* of Rand mining operations.

On Wednesday evening, Sir Thomas Holland delivered his address in the Town Hall, to a very large audience. The acoustic properties of this hall are unfortunately so bad that it was difficult for members far away from the platform to follow the address closely. It dealt with the mineral resources of the world, and the possibility of maintaining the peace of the world by controlling them, and is likely to lead to much further discussion. The president was complimented by General Smuts for having inaugurated a new type of presidential address, and his vote of thanks was warmly supported by the audience.

The next morning Prof. Lea delivered his presidential address to Section G on Science and Engineering, and summarised the main point of his argument as follows: "New epoch making developments in engineering depend upon the discovery of new facts of science and upon materials and technical processes. The only hope of solving many of the problems which face the engineer to-day is by carefully organised experiment. Engineering is of such vital importance to modern life that not only manufacturers, but also large users, public authorities and governments, must be interested and provide funds for research."

The next paper was one on the National Electricity Supply Scheme in Great Britain, by Mr. C. H. Merz. This paper gave a short but comprehensive survey of the development of the national scheme, and of the economies that are anticipated by its adoption. The standardisation of frequency and the arrangements for the preparation and adoption of schemes were discussed and some account of the constructional features of the grid were given, and the reason for its erection. The paper concluded with a discussion of some of the advantages that will accrue from the development of a national system of electricity supply in ensuring a better distribution of factories and in improving the atmospheric conditions in large towns. "The extended use of power increases both the amount of wages earned and the amount of comfort these wages will buy. The grid, by lowering the cost of power, and also by making supplies of it available in many districts now without them, will expedite the attainment of both these results." A paper was then read by Prof. Marchant on the "Limits of the Economical Transmission of Electrical Energy." He pointed out that in England to-day there was very little difference between the cost of conveying B.th.u.'s as coal by rail and by high tension electrical transmission for a 100,000-kilowatt plant over 20 miles, if the station was operating with a fuel consumption of 1.5 lb. per unit. At this distance the cost of carrying coal was relatively greater, the greater the fuel consumption per unit, and *vice versa*. With a station consuming 1.5 lb. of coal per unit, the electrical method of transmission was cheaper if the distance over which the energy had to be transmitted exceeded 15 miles, and became more and more economical as the distance increased. The saving by electrical transmission also became greater as the load factor of the system improved.

The relative cost of electrical power supply by steam and hydro-electric stations was dealt with at the end of the paper, and it was shown that under the conditions existing at the present time on the Rand, it would be permissible to expend £50 per kilowatt of plant at the Victoria Falls to give a supply at the same voltage rate as that now in force for the supply of the Rand mines, *i.e.*, 0.4d. per unit with a 7 per cent. load factor.

Prof. Randall, of the Witwatersrand University, gave an account of some experiment he had been making on the insulation resistance and contact resistance of some insulating materials.

In the evening the Mayor of Johannesburg gave a reception to the delegates at which, as Dr. Hofmeyr expressed it, "the usual speeches were made by the usual speakers." A number of admirable performers gave renderings of old English songs, and Mr. Connell, the city organist, showed what the organ could do. The organ is a magnificent instrument and is said to be the finest in the Southern hemisphere.

On Friday, August 2nd, Section G continued the discussion on roads which had been inaugurated at Cape Town. Colonial Martin opening the proceedings with a contribution describing some of the improvements in road construction that had taken place in England. It then combined with Section I (the Physiology Section) to discuss some of the problems of deep-mine ventilation. This is a topic which is of great interest to engineers in Johannesburg and attracted a large audience to the Selborne Hall. The method proposed by Dr. J. S. Haldane of dry mining and preventing phthisis and silicosis by mixing graphitic and siliceous dust with the quartzite dust produced by the blasting operations did not meet with much support from mining engineers. Dr. J. H. Dobson, formerly city electrical engineer of Johannesburg, pointed out that even if the system were used, a very large percentage of moisture would be absorbed by the air in its passage through the downcast shaft and along the galleries before reaching the "stopes" where the miners were at work. The next day

* Elec. Rev., April 12th, 1929, p. 672.

(Saturday) some members of Section G went to the Robinson Deep mine and were able to examine for themselves the conditions existing at a depth of 6,000 ft. below the surface. The elaborate nature of the winding and ventilating plant, and of the plant used for extracting the 6 pennyweights of gold that was present in each ton of ore was a revelation of the complexity of gold-mining under modern conditions. Unless electrical power had been available for mining, this mine would have found it uneconomical to continue its operations some years ago. Cheap electrical power has exerted a most favourable influence on the working of this and many other mines on the Rand.

Johannesburg itself has provided a very interesting problem for the electrical engineer, mainly because of the difficulties of distribution. As in Cape Town the town has spread over a wide area. The centre portion (the old Johannesburg) is still supplied with direct current on the three-wire system, but the outlying districts are supplied with three-phase alternating current at 220 volts to earth, and 380 volts between lines. The change-over from d.c. to a.c. began soon after the end of the war, and, as in Cape Town, the supply from the sub-stations to the houses is by overhead lines supported on steel poles. The municipal station is of the type now common, with turbo-alternators of 6,000 kW, running at 3,000 r.p.m., and works quite independently of the Victoria Falls Power Co. The latter company has a station at Witbank, where coal is available at 2s. 6d. a ton, and also at Vereeniging, from which place it is transmitted at 132,000 volts to sub-stations in the mining area.

The last meeting in Johannesburg having any electrical interest was a discussion on science and industry which took place in the Town Hall on Friday evening. Faraday was the hero of this discussion, for he was referred to by every speaker who took part in the debate.

At the conclusion Sir Thomas Holland referred to the remarkable success of the meetings, both in Cape Town and Johannesburg, to the great interest that had been aroused in science and its applications, and to the excellence of the reports that had appeared in the Press. Thus ended a most memorable meeting.

On Saturday evening, and on the following days, the delegates set out on the various tours that had been organised, some by the Carden Route to Port Elizabeth and Cape Town, others to the Victoria Falls and the ruins at Zimbabwe. The only remaining items in the programme were some lectures that were to be given in Durban and other towns which wished to take advantage of the presence in the country of so many people both able and willing to lecture.

Rural Electrification.

The author's investigations in different parts of England have convinced him that, with the aid of the Wilkinson change-circuit system of distribution and a high load factor, the electrification of country districts can be made a paying proposition.

By W. E. MILTON AYRES, A.M.I.E.E., Mem.A.I.E.E.

IN this country rural electrification has been very backward. The Electricity Commissioners' report shows that out of a rural population of some 9,000,000 inhabitants, only an infinitesimal percentage makes use of electricity.

There are two main reasons: first, the electricity supply industry has been built up by local endeavour, which has naturally limited it to industrial and urban areas that could find the necessary capital. Secondly, where electricity has been transmitted through rural areas any small rural load which has been connected has been considered merely as a convenient "by-product."

The condition of millions of our rural population, without water, gas, or electricity laid on compares badly with such a country as Switzerland, where 98 per cent. of the population has electricity supplies available. In addition, the cost of fuel is often very high, due to freightage and cartage charges.

Rural Load v. By-Product.

The scattered nature of the rural load has led to a high cost of distribution equipment, which in turn has led to high charges for electrical service. This high charge has limited its use to lighting and sundry domestic uses, which means a very low load factor and consequent high ratio of capital charges to cost per kWh. This sequence is obviously a vicious circle, destructive to the development of rural electrification.

As with most other arguments which end in such a circle, there is an equally true converse. An abundant supply of electricity at prices which are attractive, with a system planned comprehensively to operate at a reasonably high load factor, can be made to earn dividends on the capital required.

The two predominant factors are (*a*) favourable terms to induce abundant use of electricity, and (*b*) high load-factor ratio to utilise the invested capital to the utmost advantage; these two conditions are completely interdependent.

Farm work includes a number of possible small-power motor applications which, individually, occupy a small time in the day, but in general do not overlap, so that the diversity factor is good. Such small power uses include: water pumping to supply tanks, electric milking machines, chaff and root cutting, winches and conveyors, threshing blowers, and dairy uses. In some districts land drainage by electric pumps is profitable to the farmer, instead of deep ditching as at present practised. This, incidentally, may be a night load in many instances. All of the above are common practice in Holland, Sweden, and the British Colonies, and create a higher standard of life for the farmer and farm labourer. In addition to the farm applications, there is the village smithy, carpentry, garage, &c., to fill in the load valleys.

It remains, however, to find useful load to fill up the gaps over the 24 hours of the day and increase the overall load factor if rural electrification is to be made an attractive economic proposition. This, the writer considers, is the pivot of the whole problem, and rural electrification without load levelling is doomed to economic failure.

Constant Load Change-Circuit Distribution.*

The essential principle of this system is a dual system of supply with one conductor common to both. The constant-pressure circuit delivers energy to the lighting, cooking, and motive power load, whilst a variable-voltage circuit delivers power to thermal-storage devices. Automatic control, initiated by the input current to the sub-station transformer (or its equivalent) adjusts the variable voltage to such a pressure that the sum of the loads on the two supply circuits is constant. One extra

* ELECTRICAL REVIEW, January 27th, 1928, p. 167, and July 12th, 1929, p. 51.

conductor per phase is required, and in the case of overhead distribution it may be steel, as the current it will have to carry is only about 40 per cent. of the main supply current; also a little more pressure drop in distribution may be allowed.

Change-Circuit Load.

A number of applications which are at present accomplished by burning fuel can be economically performed with the variable-voltage supply system by means of "off-peak" thermal storage, *e.g.*, domestic and dairy hot-water supply, sterilising, cooking of pig and poultry food, heated horicultural frames for early salads, &c., and with a considerable reduction in labour for attention and cleansing. Moreover, the supply of hot-water is always available without any loss of time, and other applications are under simpler and more exact control. It is feasible that in some cases a proportion of central heating by thermal storage may be included, but this is seasonal and must be balanced against other seasonal loads if a good overall yearly load factor is to be maintained.

Cost of Distribution and Services.

Many rural districts in England are particularly favourable for electrification, as a very large proportion of the inhabitants live in, or adjacent to, villages which form convenient centres of distribution. Statistics taken from a typical country district, after deducting the municipal boroughs and urban districts wherein electricity supplies are already available, show an area of 1,930 square miles for 376 villages and townships; an average of 5 square miles, or a radius of 1¼ miles, which is very convenient for low-voltage distribution on the standard 400-230-volt system.

The rural population of the area is approximately 220,000, of which 83 per cent. lives in villages or townships, leaving only 17 per cent. on scattered farms. The problem is, therefore, a twofold one of providing a domestic supply to the 83 per cent. and a complete supply with power to the 17 per cent.

Schemes worked out on a 25-in. ordnance map show that the capital cost of the distribution system per consumer, assuming that 70 per cent. of the population within 1¼ miles radius of the low-voltage sub-station is connected to the supply mains, and including everything from the "grid" step-down transformers to consumers' terminals, with overhead l.p. distribution, may be :—

Lighting and small sundry domestic load ...	£22
Lighting with change-circuit	£27
Lighting, &c., with cooking	£34
Lighting with cooking plus change-circuit ...	£41

Cost of Energy Consumed.

To estimate the cost of energy used we will assume the price which has been quoted for the "grid" at £3 10s. per kW, plus 0.23d. per kWh and add 25 per cent. for losses in transmission and distribution. Each consumer averages approximately five persons, therefore :—

40	kWh	per	head	p.a.	for	lighting, &c.	=	total 200	kWh p.a
360	,,	,,	,,	,,	,,	cooking	=	,, 1,800	,, ,,
720	,,	,,	,,	,,	,,	hot water	=	,, 3,600	,, ,,
Plus	400	kWh		,,	,,	radiation loss		400	,, ,,
		Total	...	...	...	...		6,000	,, ,,

Revenue.

With diversity of applications it is obviously necessary to apply a two-part tariff, which should be simple in application, but encourage the use of electricity. For this purpose 16s. per room p.a., plus one penny per kWh, would form a suitable basis for calculation. The average one may assume as a 5-roomed house, which works out at £1 per quarter standing charge.

For the change-circuit "off peak" load, which is a load to be encouraged to bring down the general charges and increase the revenue upon capital invested, a suitable charge would be 0.40d. to 0.50d. per kWh, but a variable-voltage supply cannot be metred, so one must make a charge on the kW of water heaters installed. In the average case cited in Table I this result would exactly be obtained with a 1-kW heater, so we will allow a charge of £2 per quarter (equivalent to 1 ton of coal) for the constant hot-water supply; this would work out as 0.48d. per kWh.

The value of the change-circuit load is well shown by the above illustrations in spite of the cost of transmission for rural areas. A calculated surplus is allowable in the case of the change-circuit system application until more information is available as to its working; ultimately the cost may be reduced.

TABLE I.

	1 Lighting and sundry domestic appliances.	2 Ditto with electric cooking.	3 As column 2 with hot water.
Capital cost per consumer	£22	£34	£41
Consumption, kWh p.a.	200	2,000	6,000
Max. demand with diversity	0.20	1.0	1.0
Load factor, per cent.	11.3	23	68
Max. demand at £3 10, plus 25 per cent. ...	£0 17 6	£4 7 6	£4 7 6
kWh consumed at 0.23d. plus 25% ...	£0 4 10	£2 8 0	£7 4 4
Total costs of kWh ...	£1 2 4	£6 15 6	£11 11 10
* 16 per cent. on capital	£3 10 3	£5 9 0	£6 13 0
	£4 12 7	£12 4 6	£18 4 10
Cost per kWh ...	5.6d	1.47d.	.733d.

* This figure includes 8 per cent. interest on invested capital 3 per cent. sinking fund, and 5 per cent. management charges

TABLE II.

	1 Lighting and sundry domestic appliances.	2 Ditto with electric cooking.	3 As column 2 with hot water.
Five rooms at 16/- ...	£4 0 0	£4 0 0	£4 0 0
200 kWh at 1d. ...	0 16 8	—	—
2,000 kWh at 1d. ...	—	8 6 8	8 6 8
£8 p.a. per kW of heaters	—	—	8 0 0
Revenue	£4 16 8	£12 6 8	£20 6 8
Expenditure, including interest ...	4 12 7	12 4 6	18 4 10
Surplus	£0 4 1	£0 2 2	£2 1 10

Isolated Farms.

In this case we may take £120 as the average capital charge on the transmission line and transformer, and 5-kW load for motive power with a peak (allowing diversity factor) of 3 kW. The extended use of hot water may require 3 kW of immersion heaters, but the charge per kW may have to be reduced to £7 p.a. = 0.35d. per kWh.

Thus :—

Consumption, lighting ...	300	
Cooking	2,000	
Hot water, &c....	9,000	
Motive power	4,000	
Total	15,300 kWh p.a.	
Maximum demand = 3 kW.		
At £3 10s., plus 25 per cent. ...	£13	3 0
0.23d. per kWh, plus 25 per cent.	18	7 0
16 per cent. on £120	19	4 0
Total cost	£50	14 0
Cost per kWh, 0.795 pence.		
Revenue, 8 rooms at 16s. ...	£6	8 0
6,300 kWh at 1d.	26	2 6
3 kW heaters at £7 p.a. ...	21	0 0
Total revenue	£53	10 6
Surplus	£2	16 6

The above figures indicate that a paying proposition can be made of rural electrification, even in the case of isolated farms, except in extreme cases; but it is necessary to arrange for a high load factor to make the scheme economically feasible.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The South American Mission.

The British Economic Mission which has been sent by the Government to investigate conditions in Argentina and Brazil, has provisionally concluded an agreement with the Argentine Government by which the latter will purchase £8,000,000 worth of British goods during the next two years while Great Britain will purchase Argentine food products to the same amount. The British products are required for the railway and public works development schemes which the Argentine Government has in hand.

The Commission proceeded on September 9th to Montevideo (Uruguay) for a short stay, thereafter going to Brazil.

Unemployment.

A decrease of 6,484 in the number of registered unemployed was recorded for the week ended August 26th. The total at that date was 1,155,800, as compared with 1,162,284 on August 19th, and 1,320,027 on August 27th, 1928.

Recent Contract.

The Times reports that an order for 30 40-ton side discharging wagons has been placed with the Birmingham Railway Carriage and Wagon Company by the London Midland and Scottish Railway Company. The wagons have been designed for the experimental conveyance of coal in bulk between certain collieries capable of handling wagons of this size, and the L.M. & S. Railway's electric power station at Stonebridge Park, which supplies energy for the Watford electrified lines. It will be possible to empty and clear a train of 12 of these wagons, which are completely self-discharging, in about 30 minutes. The wagons, which have a capacity of 1,794 cubic feet, are 32 ft. long, 8 ft. 11 in. wide, and 10 ft. 9 in. high.

The Japanese Electrical Industry.

As indicating the progress that is being made in the electrical engineering industry in Japan, it may be mentioned that the Shibaura Engineering Works, Ltd., has recently completed four 8,000-kVA, 11,000-V generators for the Keretsubo power station of the Tokyo Electric Power Co. The power station of the Kidogawa Hydro-Electric Co. has also been equipped with two 4,440-kVA, 6,600-V generators driven by vertical shaft turbines constructed by the Hitachi Engineering Works, Ltd.

The German Radio Industry.

In discussing the situation of the German wireless industry in connection with the Berlin Radio Exhibition, a Berlin correspondent states that although no syndicate exists in this industry, the idea has for a long time past been in view of reaching an understanding among makers with regard to sale prices and conditions. At the same time it is noted that the large firms already come to an understanding at times in the matter of fundamental questions. Since 1923 the Union of the Wireless Industry has specially applied itself to the patent branch so as to prevent the rights of its member firms from being infringed through the illegal manufacture of receiving sets. The Union also looks after the interests of its members in relation to the Reich postal authorities and the Reich broadcasting company and is in close contact with the association of merchants and other bodies.

The World's Electrical Exports.

Statistics have been prepared by the Central Union of the German Electrical Industry with regard to the world's turnover of electrical manufactures in pre-war years and at the present time. According to the figures the German exports in 1928 represented 536 million marks, as compared with 366 millions in 1925 and 331 millions in 1913. The value of the exports from the United States in 1928 is quoted at 448 million marks, as against 354 millions in 1925, and those of Great Britain at 377 million marks in 1928, as against 356 millions in 1925.

The aggregate value of all exporting countries is stated to have increased from 700 million marks before the war to 1,864 millions in 1928, the growth being ascribed to the progressive extension of electrical applications in new spheres. Prior to the war it is stated that Germany occupied the leading position in the export trade, accounting for 46 per cent. of the world trade, but her share declined to 25.8 per cent. in 1925. In the meantime the German exports have again largely increased and they formed 28.8 per cent. of the world exports in 1928, whereas the exports from the United States receded to 24 per cent. and those from England to 20 per cent.

French Foreign Electrical Trade.

The appended table shows the French imports and exports of electrical machinery, fittings, and allied material during the first half of the current year as compared with the corresponding six months of 1928. It will be seen that the imports show an advance of £464,965, and that, on the other hand, the exports declined to the extent of £19,210. The values have been converted on the basis of 124 francs to the £.

	Imports. Jan. to June.		Exports. Jan. to June.	
	1928.	1929.	1928.	1929.
	£	£	£	£
Dynamo-electric machines, transformers and parts	115,385	170,330	240,400	172,855
Electrical apparatus ...	262,635	497,745	297,775	265,035
Incandescent lamps and parts	144,030	193,080	40,075	60,945
Arc lamps and parts ...	240	200	600	1,400
Carbons for lamps, dynamo brushes, &c. ...	27,420	37,630	49,500	29,635
Electric wires and cables	53,725	151,985	64,900	109,630
Electrical fittings & parts	44,120	51,590	58,435	68,080
Magnets	725	2,945	605	1,400
Accumulators and parts ...	10,410	10,920	36,950	57,790
Dry batteries and condensers	1,630	4,305	13,305	14,365
Porcelain and glass insulating material	5,170	9,695	26,845	29,055
Totals	£665,490	£1,130,425	£829,400	£810,190

Great Britain's Radio Exports.

Statistics published by the *Wireless and Gramophone Trader* show that during June last radio equipment valued at £82,535 was exported from this country, including valves with a value of £22,422. Australia was the principal destination, goods valued at £19,298 (valves, £9,584) having been dispatched to the Commonwealth. Holland's share amounted to £8,511 (valves, £2,187). Kenya Colony's share was valued at £4,992 (valves, £424), that of Spain at £4,793 (valves, £162), and that of South Africa at £4,021 (valves, £1,029).

The figures for the first half of the current year show radio exports valued at £610,357, as compared with £586,322 in January-June, 1928. The leading customers were :—Australia, £81,621 (against £76,332), the Netherlands, £79,222 (against £37,281), Japan, £53,848 (against £45,383), Spain, £33,166 (against £14,364), Argentina, £31,291 (against £15,388), and the Irish Free State, £26,201 (against £22,622).

Dutch Cables for Salford.

At its meeting on September 4th, the Salford City Council approved a recommendation of the Electricity Committee to accept the tender of the Nederlandsche Kabelfabriek, Holland, for electric cables at £8,428. Alderman Billing, chairman of the Committee, stated that the Dutch tender was 14 per cent. below the lowest British offer. Councillor Moylan moved an amendment that the lowest British offer should be accepted. He said that the Council had never taken account of the unequal factors that entered into the competition of foreign firms. Another member of the Council said that by the acceptance of Dutch tenders in the past the ratepayers had been saved £10,000 directly and £10,000 in interest and loan charges.

An Electrical Company's Jubilee.

Messrs. E. M. EVANS & SON, LTD., Manchester, inform us that they have now been in business as electrical contractors for 50 years, during which period they have carried out many important contracts in connection with the lighting of country mansions, the electrical equipment of mills and works, &c. They have been responsible for the introduction of a number of new features in installation work, among them being the "Konseel" wiring system. We extend our heartiest congratulations to Messrs. Evans upon their record.

Book Notices.

"Pitman's Technical Dictionary of Engineering and Industrial Science," in seven languages, compiled by E. Slater, in collaboration with leading authorities. Four vols. London: Sir Isaac Pitman & Sons, Ltd. Price £8 8s. net the set.

"Private Automatic Branch Exchanges," by R. T. A. Dennison. Pp. ix+291; fig. 98. Price 12s. 6d. net. London: Sir Isaac Pitman & Sons, Ltd.

"Technical Report for 1928." (155 pp. of text and 39 pp. of illustrations and diagrams.) Manchester: The British Engine, Boiler & Electrical Insurance Co., Ltd. Price 7s. 6d.—The contents of this report are almost entirely devoted to the results of the company's investigations into the use of welding for pressure vessels, a subject of growing importance to those concerned with the maintenance of power plant.

"The Welder." Vol. I, No. 1. September, 1929. (24 pp.) London: Alloy Welding Processes, Ltd.—This is the first number of a little bi-monthly journal which is devoted to the various phases of arc and oxy-acetylene welding.

"The Fusion Point of Coal Ash." (Part 1). Fuel Research Technical Paper No. 23. (Pp. 19, 7 figs. and one plate). London: H.M. Stationery Office. Price 1s. net.

The *Sunday Pictorial* has issued a specially prepared map of England and Wales in which the counties are shown in distinctive colour. For each county the number of families is given and the number of *Sunday Pictorials* sold, the "penetration" percentage being worked out on this basis.

"The Units and Standards of Measurement Employed at the National Physical Laboratory." Pp. 42. London: H.M. Stationery Office. Price 1s. net.—This pamphlet is a reprint of a section of the report of the Laboratory for the year 1928.

The British Broadcasting Corporation has issued a programme of talks and lectures for the period from September to the end of December. It has also published a booklet dealing with crystal receiving sets and the Brookman's Park transmitter, in which an endeavour is made to explain the necessity for the new regional station, the results to be expected from it, and the simple steps that listeners should take to adapt their apparatus to meet the new conditions.

Rumanian International Wireless Exhibition.

An International Wireless Exhibition was opened in Bukharest on September 1st. All the most important foreign firms are exhibiting. Representatives of the Government were present at the inaugural ceremony. There are special pavilions for showing household electrical appliances, &c.—*Reuter* (Bukharest.)

Trade Announcements.

Messrs. J. S. THURKETTLE and J. A. LUMB have been appointed by the FOSTER ENGINEERING CO., LTD., joint branch managers of their Sheffield depôt. Mr. J. A. Lumb for the past 15 years has acted as their Sheffield agent, and Mr. J. S. Thurkettle as chief lamp salesman for the Sheffield branch of the British Thomson-Houston Co., Ltd. The Foster Engineering Co. will shortly open new premises in Mappin's Buildings, Norfolk Street, Sheffield.

Messrs. W. H. AXWORTHY & Co., electrical contractors, Plymouth, announce their removal to 106, Tavistock Road, Plymouth.

Mr. R. W. WHITLEY has been appointed London manager to Messrs. J. H. TUCKER & CO., LTD., and he took up his duties on September 9th at 101, Dean Street, W.1.

The ALDERSHOT GAS, WATER & DISTRICT LIGHTING CO., LTD., is opening in October electricity showrooms at Hindhead, and in December similar premises in East Street, Haslemere.

The telephone number of the PREMIER COOLER & ENGINEERING CO., LTD., has been altered to Temple Bar 6161.

The TELEGRAPH CONDENSER CO., LTD., announces that as Messrs. Green & Jackson, of Birmingham, have dissolved partnership, Mr. P. H. Jackson, trading as P. H. Jackson and Co. has now taken over the sole agency for the T.C.C. condensers in the Midland territory.

Mr. J. R. MORRIS, Imperial House, Kingsway, states that his telephone number is now Temple Bar 3038.

New Catalogues and Lists.

Messrs. F. TURNER (ART METAL), LTD., 61-63, Summer Hill Street, Birmingham.—An illustrated leaflet describing the "Plus" extensible rule. Priced.

Messrs. J. H. TUCKER & CO., LTD., King's Road, Tyseley, Birmingham.—Folder F2 containing illustrated particulars and prices of "Tucker" fuseboards with from two to sixteen ways, teak and iron cased.

HIGH TENSION BAKELISED PRODUCTS, LTD., 49, Moor Lane, E.C.2.—List No. 135 giving particulars of "Bakereen" sheets and panels. Priced.

Messrs. FALK, STADELMANN & CO., LTD., 83-93, Farringdon Road, E.C.1.—List No. 617 containing very complete particulars, illustrations, and prices of "Sunstar" reflectors for shop window lighting.

ELECTROSERVICE, LTD., 3, Waterloo Road, S.E.1.—An illustrated price list of electric lamps, lighting fittings, bells, domestic appliances, &c.

Messrs. W. CROCKATT & SONS, LTD., 62 and 64, Darnley Street, Glasgow.—An illustrated booklet describing the company's "Simplex" patent electric salinometer, and giving instructions regarding its installation and operation. A list of users of the apparatus (mainly marine) is included.

BERRY'S ELECTRIC (1928), LTD., 85-87, Newman Street, Oxford Street, W.1.—An attractive catalogue containing details of the company's "Magicoal" and other fires for the coming season. The publication is well illustrated, there being several coloured plates, and prices are given.

Mr. ALAN WRIGHT, 117, Victoria Street, S.W.1.—A new list of "Inventum" electric fires, containing fully-illustrated particulars and prices of about a dozen models. Also a showcard in warm colours advertising "Inventum" fires.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—September stock list of motors, dynamos, transformers, &c. Illustrated.

The FOSTER INSTRUMENT CO., Letchworth, Herts.—Book 45, containing illustrated notes upon optical and radiation pyrometry with particular reference to the firm's instruments.

The MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A list of Marconi valves (including about 50 types) for the forthcoming season. Priced.

Messrs. H. W. SULLIVAN, LTD., Leo Street, Peckham, S.E.15.—Catalogue of electric fires, cookers, &c., for the 1929-30 season (52 pp.). Each item is illustrated and priced.

The ALBERT & J. M. ANDERSON MFG. CO., 12, Moor Lane, E.C.2.—An illustrated pamphlet dealing with the "S. & A." device for attaching tags to live or faulty wires.

The IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.4.—Print No. 1,014, illustrating one of the company's self-acting polyphase starters for squirrel-cage motors—"Across-the-line" type.

The A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1.—September stock list of d.c. and a.c. motors, drills, fans and other electrical appliances. Priced. Also a leaflet advertising the "Vampire" vacuum cleaner.

Bankruptcy Proceedings.

R. A. READ, electrical engineer and wireless dealer, 9, The Pavement, Middle Lane, Crouch End.—The public examination of this debtor was held on September 3rd before Mr. Registrar Warmington at the London Bankruptcy Court, the accounts showing liabilities of £810, and assets valued at £219. In reply to Mr. Armstrong, Assistant Official Receiver, the debtor stated that prior to September, 1926, he was employed as a process inspector to an electrical company. In the following November he borrowed £50, and with £75 capital acquired a lease of a lock-up shop at 2a, The Pavement, and began to trade as an electrical engineer, dealing mainly in wireless goods. After trading fairly successfully for two years he removed to 9, The Pavement. In March, 1929, he realised he was in financial difficulties, and in April he acquainted his principal creditors with the fact, but continued to trade until July 16th, when he presented his petition because three judgments had been obtained against him. The debtor attributed his insolvency to lack of capital, heavy overhead charges, liability under the leases of the business premises, and a tenancy of his private house, and to insufficiency of profits to cover drawings. The examination was concluded.

The following are creditors:—

	£		£
British Thomson-Houston Co., Ltd....	29	Mullard Wireless Service Co., Ltd.	30
Dickeson, C. B., & Son	48	Noble, C. H.	50
General Electric Co., Ltd.	86	Read, Miss B. L.	100
Houghton-Butcher, Ltd.	54	Siemens Bros. & Co., Ltd.	26
Hotpoint Electrical Appliances, Ltd.	28	Stearn Electric Co., Ltd.	31

O. B. TURNER, Paddock House, Yeadon, Yorks., salesman of electrical apparatus.—The receiving order in this matter was made on the debtor's own petition on August 12th. At the first meeting of creditors held on August 29th at the Official Receiver's office, Leeds, a statement of affairs was presented showing liabilities amounting to £114, with no assets. The case being a summary one was left with the Official Receiver.

D. B. JOHN (D. B. John & Bros.), electrical engineers, &c., 8, Commercial Place, Pontycymmer, and Nanther Stores, Nanther Road, Blaengarw.—Last day for proofs for dividend, September 20th. Trustee, Mr. E. Owen, Official Receiver, 34, Park Place, Cardiff.

A. J. GARROD, manufacturer of valves, sets and parts, Whitehorse Place, Wellingborough.—Trustee, Mr. P. R. E. Smith, Church Street, Wellingborough, released August 1st.

Company Liquidations.

BAYLISS, MARCH & NEWEY, LTD.—The statement of affairs presented at a meeting of creditors on August 30th, disclosed liabilities of £3,441 (of which £2,254 was due to trade creditors), and net assets of £670, leaving a deficiency of £2,771. The issued capital was shown as £3,450. The liquidator, Mr. W. F. Bridgwater, 3, Cherry Street, Birmingham, reported that the company was formed in 1923 with a capital of £1,300 to take over the small businesses of "March and Newey" and "Bayliss and Duddleston." In the same year further shares were issued to the extent of £1,700. The first directors were the late Mr. F. W. Bayliss and Messrs. F. C. R. Bayliss (chairman), H. March and W. Newey. The first year's trading produced a profit of £336, the second year a loss (after charging depreciation) of £575, the third year a profit of £51, and the fourth a profit of £35. In 1925, Mr. F. C. R. Bayliss guaranteed a bank overdraft, which guarantee the bank still holds. Mr. H. March resigned from the board in

November, 1925, and Mr. Preece was elected in his place. In the later months of 1927 the position of the company became serious. As it became necessary to raise more money a first debenture of £300 and an unsecured loan of £200 were obtained. At this time Messrs. Newey and Preece resigned from the board and commenced trading in opposition, and the sales fell off. In December, 1927, Mr. H. S. Seccombe took up £497 preference shares for cash, and joined the board. At that time a revaluation of the assets showed that the assets exceeded the liabilities (excluding the share capital) by £150. A reorganisation then made resulted in a considerable, though not sufficient, improvement in trade. In December last a second debenture of £300 was issued and a further unsecured loan of £300 was made. The past year's results, owing partly to special expenditure on tools and dies for a new department, showed a loss of £718. The early months of this year showed improved sales and some large contracts were secured and promised. The business to the end of June was maintained at the improved rate of sales but in July certain suppliers refused further deliveries of material although their accounts had recently been diminished. This rendered further trading impossible, and upon the service of a writ by one of the smaller creditors, Mr. Bridgwater was appointed receiver for the debenture holders and the company then went into liquidation.

The *London Gazette* of September 6th contains the following correction :—" In the notice which appeared in the *London Gazette* of August 13th, 1929, ' Special Resolution of the British Marconi Co., Ltd.,' the word Marconi was inadvertently printed for the word Macaroni. The notice referred to should read British Macaroni Co., Ltd."

Private Arrangements.

INTERNATIONAL ELECTRIC CO., LTD., Tottenham.—Messrs. Stoneham & Sons, solicitors, 108a, Cannon Street, E.C.4, state that, in accordance with the resolution passed at a meeting of trade creditors held on April 23rd last, the moratorium deed has now been approved, completed and executed by members of the creditors' committee. Notes of acceptance have been sent to the creditors for signature. (A report of the meeting referred to appeared in our issue of May 10th, p. 830.)

Dissolution of Partnership.

H. BIBBY & Co., electrical engineers, 4a, Bold Street, Warrington.—Messrs. E. S. Bibby and H. Horrocks have dissolved partnership. Mr. Horrocks will attend to debts and continue the business under the same style.

United States Tariff Changes.

In the *Board of Trade Journal* dated September 5th there appears a schedule of alterations which the United States Senate Finance Committee proposes shall be made in the Customs tariff. Among these alterations is one designed to include under Paragraph 353 " all articles suitable for producing, rectifying, controlling or distributing electrical energy; electrical telegraph, telephone, signalling, radio, welding, ignition, wiring, therapeutic, and X-ray apparatus, instruments (other than laboratory), and devices; and articles having as an essential feature an electrical element or device, such as electric motors, fans, locomotives, portable tools, furnaces, heaters, ovens, ranges, washing machines, refrigerators, and signs." These goods (and component parts) would be subject to an *ad valorem* duty of 30 per cent It is stated that the current duty varies from 30 to 50 per cent. It is proposed that filamentless electric lamps shall be charged at 20 per cent. *ad valorem*; lamps with metal filaments at 25 per cent.; and lamps with carbon or other non-metallic filaments at 1 cent each and 30 per cent. *ad valorem*. Arc lamp carbons less than ¼ in. in diameter would pay a duty of 60 per cent. *ad valorem*, and larger sizes 45 per cent. The duty proposed on illuminating globes and shades is 85 per cent. *ad valorem*.

Estonian Foreign Electrical Trade.

According to the *Board of Trade Journal*, the imports of " electric machines, apparatus and implements " into Estonia during June had a value of 282,000 kr. (£15,500), while exports of the same class were valued at 26,200 kr. (£1,440).

Prices of Materials.

Messrs. F. Smith & Co. report, September 10th : Copper (electrolytic) bars, £85 5s., 10s. inc.; ditto ditto sheets, no change; ditto ditto wire rods, £95 5s., 5s. inc.; ditto ditto h.c. wire, 11¾d., 1/16d. inc.

Messrs. James & Shakespeare report, September 10th : No change in the prices of copper bars (best selected), sheet and rod; English pig lead, £24 15s., 5s. dec.

Messrs. Edward Till & Co. repor, September 10th : India-rubber, Para fine, 10½d., ½d. dec.

Messrs. James Forster & Co., in their letter dated September 7th, stated that the lead market was not so active last week, but prices were well maintained and closed at the highest. Demand in this country is rather quiet and confined to purchases of early arrival lead of which a scarcity has developed, so that the small contango on prices has disappeared. This will probably be only temporary, however, as there is no reason to anticipate any shortage of supplies against September contracts. The future is obscure and depends very much on the tactics employed by the newly founded Lead Producers' Association.

Lighting and Power Notes.

Abergavenny.—BULK SUPPLY.—As a result of an interview with the Electricity Commissioners, the Town Council has decided to obtain terms for a bulk supply of electricity from the South Wales Electrical Power Distribution Co., the West Gloucestershire Power Co., Ltd., and the Shropshire, Worcestershire and Staffordshire Electric Power Co.

Barnoldswick.—ELECTRICITY SUPPLY.—It is announced that the Barnoldswick electricity undertaking will have a supply of electricity available within a few days. The Council has received 263 applications for supplies.

Birkenhead.—LOAN.—The Town Council has applied for sanction to a loan of £3,875 for excess expenditure incurred in connection with the scheme for the erection of h.p. transmission lines under the Wirral Special Order, 1925.

Bolton.—LOANS.—The Corporation Electricity Committee is seeking sanction to loans of £75,000 for mains, and £25,000 for sub-stations, transformer kiosks and equipment.

Burnley.—METER STAMPING.—The Electricity Committee has decided to support a resolution of Newcastle County Council urging the Government to introduce legislation requiring the certification and stamping of all electricity meters.

CHANGE-OVER COMPENSATION.—The Corporation has refused a request for compensation for alterations to wireless sets necessitated by a change-over of system and pressure of supply of electricity to houses at Rosehill.

Canada.—HYDRO-ELECTRIC DEVELOPMENTS.—A report of the Water Power Branch of the Canadian Department of the Interior states that during the first half of the current year new hydro-electric developments have increased the power resources of the Dominion by 200,000 h.p., while works in course of construction will add 2,000,000 h.p. to the total. Installations already completed in Quebec during the year, include the addition of four units to the Chelsea and Farmers development of the Gatineau Power Co., of 34,000 and 24,000 h.p., respectively; of the second unit of 25,000 h.p. at the company's Bryson's development; and of a 43,000-h.p. unit to the Shawinigan Falls development of the Shawinigan Water & Power Co. At Chute à Caron, on the Saguenay River, the Alcoa Power Co. is making rapid progress with a scheme which will have an initial installation of four 65,000-h.p. units. The Montreal Island Power Co. has made good headway with a scheme on the Rivière des Prairies, which will have an initial installation of six 8,800-h.p. units, which will be increased ultimately to 1,000,000 h.p. The Gatineau Power Co. has almost completed a dam at the outlet of the Cabonga Lake at the head waters of the Gens-de-Terre river, for the storage of 45,000,000,000 cu. ft. of water to supply the power stations on the lower Gatineau river. Prospective developments in Quebec include those of the Shawinigan Water & Power Co. on the upper reaches of the St. Lawrence river, with a projected installation of 1,000,000 h.p. at three or four sites; an 80,000-h.p. scheme by the Gatineau Power Co. at Nigger Rapids on the Gatineau river; a 30,000-h.p. plant at Chat Falls on the Ottawa river by the Chat Falls Power Co.; and the 500,000-h.p. scheme of the Beauharnois Light, Heat, & Power Co. on the St. Lawrence. The Shawinigan Water & Power Co. will develop a storage reservoir on the Mattawin river, which will allow the addition of 100,000 h.p. to the company's plants at Grand'mere, Shawinigan, and Labelle.

Continental.—FRANCE.—The French Syndicat des Entrepreneurs de Reseaux et de Centrales Electriques has recently issued a return on the position of electricity supply in France at the beginning of the current year. Out of 37,981 towns and villages in the country, 22,479 have now a supply of electricity available, as against about 6,000 at the end of the war. The total capacity of the public service electricity plants now in operation in France is 6,085,756 kW, the total being made up of 4,349,017 kW in steam plants, 1,599,677 kW in hydro-electric stations, and 137,062 kW in miscellaneous installations.

PORTUGAL.—According to a report recently published by the *Revista du Associacao dos Engenheiros Civis Portugueses*, there were at the commencement of the current year 69 hydro-electric power stations, with a total capacity of 33,634 kW, and 285 other power stations, with a total of 102,088 kW, in operation in Portugal. The total output during last year amounted to 216,865,558 kWh, an increase of 16 per cent. over 1927.

GERMANY.—A new 43,000-kVA steam turbo-generator set, constructed by the Siemens-Schuckert Werke at its works at Mulheim, has recently been installed at the Fortuna II power station, near Cologne, of the Rhenish-Westphalian Electricity Supply Co.

SWITZERLAND.—Work is steadily proceeding on the construction of a hydro-electric power installation near the Grimsel Pass, which unites the Rhone Valley with the Valley of the Aare, a tributary of the Rhine. The plant, when completed, will be the most powerful in Europe, and will develop

a total of 360,000 h.p. The different installations, reservoirs, conduits, power stations, &c., will extend for about 12½ miles, and will utilise a fall of 3,936 ft. at different levels. The building of the Grimsel plant necessitates extensive preparations and installations, including the construction of a dam, which will close the gorge of the Aare and will form an artificial lake about three miles in length.

Droxford.—SPECIAL ORDER.—The Rural District Council has considered an application from the West Hampshire Electricity Co. for its consent to a Special Order authorising the company to supply electricity in the Droxford rural district, with the exception of the parish of Hambledon, which is to come within the Portsmouth area of supply. The Council has informed the company that it considers that the distributing mains proposed to be laid within a period of two years from the commencement of the Order are insufficient and would not afford an adequate supply of electricity to meet the needs of the inhabitants of the district, and that it is not prepared, therefore, to give consent unless better facilities are arranged.

Earby.—ELECTRICITY SCHEME.—There has been considerable unavoidable delay in the electricity scheme, but arrangements have now been made to commence operations on September 29th. The Nelson Corporation is to supply the electrical energy in bulk, and the contractors are W. T. Henley's Telegraph Works Co., Ltd. Many applications have already been received for supplies.

Eastbourne.—YEAR'S WORKING.—We have received from Mr. J. K. Brydges, borough electrical engineer, a copy of his report together with a statement of accounts for the year ended March 31st last. The total revenue amounted to £120,843, as compared with £106,075 in the preceding year. The working expenses increased from £58,504 to £69,676, leaving a gross profit of £51,167 (£47,571), to which income from other sources was added making a total of £56,615 available. Capital and other charges absorbed £40,821, and there was a net surplus of £15,794, as compared with £14,737 in 1927-28. The capital expenditure during the year amounted to £83,107, the principal items being £38,872 for mains and services, and £29,274 for machinery. The total now spent on the undertaking stands at £651,881. The sales of electrical energy increased from 10,768,838 to 13,292,679 kWh, and the maximum supply demanded from 6,962 to 8,015 kW. The average price obtained per kWh fell from 2.10d. to 1.94d. The third 2,500-kW generator with boiler was put into service in December last. Five new sub-stations were built and equipped during the year, and three others situated on consumers' premises adapted and equipped.

COOKER INSTALLATION.—The Corporation Electricity Committee has decided that, in addition to the 30 ft. of wiring for cookers free of charge, the second main switch shall be included.

Glasgow.—AUXILIARY CABLES.—The Corporation has granted sanction to the district engineer, Central Electricity Board, to the laying of an auxiliary pilot cable in connection with the Central Scotland Electricity Scheme, to connect (i) the Dalmarnock and Port Dundas power stations with the Yoker power station of the Clyde Valley Electrical Power Co.; (ii) the Yoker power station with the Blackhall power station of the Paisley Corporation Electricity Department; and (iii) the Dalmarnock power station with the Cambuslang power station of the Clyde Valley Electrical Power Co.

Hastings.—NEW ELECTRICITY CHARGES.—The Town Council has adopted the following scale of charges as from the current quarter: General lighting, 4d. per kWh for the first 4,000 kWh per annum; from 4,001 to 10,000 kWh per annum, 3½d.; from 10,001 to 15,000, 3½d.; from 15,001 to 20,000, 3½d.; beyond, 3d. General lighting with slot meter, 5d. per kWh. Rental lighting with slot meter, 7d. per kWh, including 2d. towards cost of installation. Exterior lighting, 3d. per kWh. Shop window lighting after business hours, 2d. per kWh. Outside decorative lighting, 2½d. per kWh. Arc or high candle-power lighting for professional photographic purposes, 2½d. per kWh. Cinema arc lighting, 1½d. per kWh. Power, other than domestic, 1d. per kWh. Domestic power, heating and cooking, ¾d. per kWh.

India.—MANDI HYDRO-ELECTRIC SCHEME.—At a recent meeting of the Punjab Legislative Council it was decided to adopt a resolution for a committee of experts and members of the Council to investigate the Mandi Hydro-electric Scheme. In moving the resolution Chandhri Zaffarullah stated that he considered that the scheme had been undertaken too hastily, and that even at this stage, if thought unremunerative by independent experts could be abandoned. The chief engineer of the Mandi works explained that the excess of cost was due mainly to delay in the execution of the work owing to various unforeseen causes and, while welcoming a committee, said that it would further delay the progress of the works. The present estimate of a maximum of Rs. 6 crores was based on experience and was not likely to be exceeded.

The primary objects of the scheme, says *Indian Engineering*, are (1) to provide electrical energy over a wide area at rates below those at present offered, and (2) to cover expenses. The Legislative Council has voted funds for its prosecution in every budget since 1924-25. It was selected on the recommendation of the Punjab Electricity Board, after a thorough survey had been made of the water power resources of the Province and a consideration of other possible schemes. The scheme makes use of the snow-fed water of the river Uhl, a tributary of the Beas, which joins the latter in the Mandi State, about five miles east of the town of that name. Water will be diverted through a tunnel, 2½ miles long and 9 ft. 3 in. in diameter, bored through rock, and then dropped through a fall of 1,800 ft. to a power station, where 36,000 kW will be generated. This is the first stage of the scheme, and the only stage which it is at present proposed to carry out. In the second stage, by the construction of a dam, the supply will be increased to 70,600 kW. When this load has been taken up by consumers, the water can be carried onwards through three miles of open duct and dropped through a second and lower fall of 1,200 ft., generating another 48,000 kW, thereby giving a total of 118,600 kW.

CEYLON.—The Committee of the Ceylon Legislative Council appointed to investigate the position of the Government electricity undertakings has recently submitted a report to the Government, which states, that it considers that even the revised estimate of Rs. 1,43,70,000 will be inadequate to complete the Ceylon Hydro-electric Scheme. It further declares that steps should be taken to ensure that all possible facilities are given to Ceylonese to acquire knowledge and experience in the different branches of electrical engineering, and that a comprehensive scheme of training should be prepared and brought into force at the earliest possible moment.

Inverness.—HYDRO-ELECTRIC SCHEME.—The Corporation's hydro-electric scheme at the Bught is now in operation and the Town Council is asking Sir Murdoch Macdonald, M.P. for the town and county, to perform the opening ceremony.

Irish Free State.—LETTERKENNY, CO. DONEGAL.—As no reply has yet been received from the Electricity Supply Board regarding the lighting of the town during the coming winter, the Urban District Council has decided to reopen the gasworks.

LIMERICK.—A meeting of the Corporation Lighting Committee was held recently to consider the question of lighting the city entirely by electricity. The Director of Public Lighting Contracts to the Electricity Supply Board, in the course of his statement, said that Limerick was insufficiently lighted, and the Supply Board was anxious that it should be lighted well. He stated that when the Board's system came into operation the Corporation could abolish two hundred gas lamps, which would give 24,000 candle-power against candle-power of 122,000 from the 356 lamps which he would provide within two months. In addition to the 53 electric lamps at present in existence, gas lighting was now costing £2,616. He proposed to give 356 electric lamps, not including the 53 at present in use, for a sum of £1,032, which was considerably below the Corporation's estimate of £1,530 for the 53 lamps. The matter was referred to a special meeting.

LISTOWEL.—The power station and plant of the Listowel (co. Kerry) Electric Light & Power Co., Ltd., has been taken over by the Electricity Supply Board, the company being awarded £4,125 in respect of the undertaking.

Ketton.—ELECTRICITY SUPPLY.—The Rural District Council has accepted the scheme of Mr. Borlase Matthews for supplying electricity in its area. The proposed tariff on a two-part basis is: for a five-roomed house, a fixed charge of 15s. per room per annum; if 200 kWh is consumed, the "unit" charge will be 5½d. per kWh, with 4d. for 300, 2½d. for 600, and 1.9d. for 1,000 kWh.

London.—BERMONDSEY.—The Electricity Committee has considered proposals by the borough electrical engineer for the laying of mains in a large number of streets in the borough and for installing electricity in the houses in such streets, which otherwise would not have been contemplated for a considerable period. The estimated cost of these proposed works amounts to £93,247, of which sum application for sanction to the borrowing of £30,000 has already been made. The Committee has given directions for the Unemployment Grants Committee to be informed that it is prepared to submit to the Council a scheme for carrying out the works referred to, subject to financial assistance being available from the Government.

Luton.—ELECTRICITY DISCOUNTS.—The Corporation Electricity Committee has decided that a discount of 2½ per cent. be allowed off the total amount of accounts including meter rents, on the condition that the accounts are paid within fourteen days and that the existing charges of 2½ per cent. for interest on ordinary accounts not paid within one month be discontinued. The committee has also decided that, in order to reduce the charge for electricity to consumers supplied through prepayment meters, and to give them a discount for prepayment, a sum of one penny in the shilling be refunded by the collector to each consumer on the collection of the money in each prepayment meter.

TRAMWAY CHARGE.—The committee has decided that the charge for electricity supplied for the tramways shall be (*a*) a fixed charge of 15s. per quarter per kW of the plant reserved for tramway purposes, namely, 300 kW, and (*b*) a running charge per kWh supplied equal to the actual cost of fuel used per kWh generated throughout the quarter, with an addition of 25 per cent. This method of charging represents an approximate reduction of £500 per annum to the tramway undertaking.

Manchester.—LOAN SANCTIONED.—The Corporation Electricity Committee has obtained sanction to the borrowing of £17,200 for mains extensions.

Nelson.—LINK MAIN.—Application is to be made to the Electricity Commissioners by the Town Council for the approval of a draft agreement with Burnley Corporation for the provision and laying of an interconnecting main.

Northern Ireland.—BALLYMENA (Co. ANTRIM).—At a meeting of the Urban District Council, held on September 2nd, it was resolved that the town solicitor should proceed with the lodgment of documents in connection with the application for a Special Order. The chairman stated that the Council had decided to take its supply from the Antrim Electrical Company, as it had come to the conclusion that it could not install plant to supply electricity as cheaply.

Plymouth.—MAINS EXTENSION.—The Corporation Electricity Committee has recommended an expenditure of £20,000 on mains and conduits.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

MIRFIELD.—Lighting: To 5d. per kWh. Domestic heating, cooking, &c.: To 1½d. per kWh. The meter rents are to be reduced to a minimum figure of 6d. each per quarter.

BREDBURY AND ROMILEY.—Domestic power: To 1½d. per kWh.

SWANSCOMBE AND STONE.—*The Kent Electric Power Co.*—Lighting: To 6½d. per kWh. Heating and cooking: To 2d. per kWh.

HINDHEAD AND HASLEMERE.—*The Aldershot Gas, Water and District Lighting Co.*—For all purposes other than lighting: To 1½d. per kWh, as from Michaelmas, and to 1¼d. per kWh, as from Christmas next.

STAFFORD.—Two-part tariff: "Unit" charge reduced from 2d. to 1½d. per kWh.

Southport.—BULK SUPPLY CHARGES.—The Electricity Committee has received a deputation from the Birkdale District Electric Supply Co., Ltd., with reference to a revision of the price for electricity supplied in bulk by the Corporation to the company. The Corporation has recommended that as from October 1st, 1929, the charge to be made to the company for bulk supply for a period of three years shall be £4 per kW of maximum demand per annum, plus 0.35d. per kWh consumed.

Special Orders.—Application is to be made to the Electricity Commissioners by the Bideford and District Electric Supply Co., Ltd., for a Special Order authorising it to extend its area of supply to include various parishes in the rural districts of Barnstaple, Bideford and Torrington.

The Electricity Commissioners have submitted to the Ministry of Transport for confirmation a Special Order made by them authorising the Carmarthen Electric Supply Co., Ltd., to supply electricity in the parishes of Llangynor and Abergwilli in the rural district of Carmarthen.

Tramway and Railway Notes.

Continental.—BELGIUM.—The Société Nationale des Chemins de Fer Vicinaux, of Brussels, is reported to have decided upon the electrification of three narrow gauge lines in the district of the Campine. The expenditure is estimated at 5,000,000 francs.

AUSTRIA.—At a recent meeting of the Committee for Administrative Affairs, composed of members of the Vienna Town Council, the town building director stated that although it was too early to speak of negotiations between the Town Council and the firms interested in the construction of an underground railway, it was true that the tenderers of 1910—the Austrian Siemens-Schuckertwerke—had gone into the question of the pre-war cost proposals with the parent company, the A.E.G., and the designer of the North-South Underground Railway in Paris. The result of the examination would shortly be communicated to the Town Council.—*Reuter's Trade Service* (Dusseldorf.)

ITALY.—A new electric railway has recently been completed and opened for traffic between Genoa, Ovada, and Alessandria.

SWITZERLAND.—In his annual report for 1928 the chief engineer of the municipal electric tramways of Zurich states that the car-mileage advanced during the year from 9,366,400 to 10,211,847, and the number of passengers carried from 66,013,902 to 71,472,303. The receipts from passenger traffic amounted to £592,125, as against £549,517. The total receipts per car mile were approximately 14.78d., as against 14.97d., and the operating expenses, including all charges, amounted to 14.6d., as against 14.97d. in 1927.

Dudley.—TRAMWAY ABANDONMENT.—According to the *Birmingham Post*, the Streets, Tramways, and Lighting Committee, in a report issued last Friday, states that it has authorised the town clerk to complete the documents in connection with an agreement for abandoning the tramways in the borough in accordance with the resolution passed at the last meeting of the Council. The borough engineer has reported that as soon as the tramway service was discontinued it would be necessary for the tramway track and equipment to be removed, and the Committee had directed him to carry out the work when he thought fit. Under the agreement recently completed the Midland Motor Omnibus Co., Ltd., who, with the tramway company, are members of the British Electrical Federation, guarantee to pay the Corporation £6,500 per annum up to December, 1938, to pay a lump sum of £12,000 to cover the Corporation's expenditure on reconstruction of the roadway, the cost of maintenance of such roadway and the loss of rates on the tramway undertaking up to the date named. In addition, the Corporation is to receive under certain conditions a share of the profits on the omnibuses running through the town.

Glasgow.—PROPOSED RAILWAY ELECTRIFICATION.—In connection with the proposal to require railways in the city to be electrified, the Corporation Parliamentary Committee has agreed to recommend that it be remitted to the town clerk to inquire into the matter, and that, in the meantime, provisions be included in the Provisional Order to give effect thereto.

It is stated that negotiations are in progress between the Government and the London Midland & Scottish Railway Co. regarding the electrification of the Cathcart Circle, Glasgow's most important suburban line. It is estimated that the cost of electrifying all the local railways in Glasgow and district, as far out as Motherwell, would be about £3,000,000.

Irish Free State.—DUBLIN.—At a meeting held last Saturday of the court of inquiry set up to investigate the tramway employés' strike, it was stated that a report could not be presented for ten days and that the report would not arbitrate on the wages question. A suggestion was made that the parties concerned should consider (i) agreeing to accept a report on the wages, (ii) resuming the services pending the submission of a report, and (iii) endeavouring to reach a solution on the wages question on the basis of a report.

Liverpool.—INQUIRY.—A Ministry of Transport inquiry was held last week into an appeal made by the Merseyside Touring Co., and Messrs. Garlick, Buriell and Edwards, against the refusal of the Corporation to license certain motor-omnibus services in the city. The Liverpool tramway manager stated that, if these licences were granted, the financial position of the tramways would be seriously affected, and also that if the Corporation had to abolish its tramway services and substitute 'buses a loss of £3,500,000 would have to be faced. Mr. K. Macmorran, who conducted the inquiry, said he thought that the Corporation was taking a very unreasonable attitude; it was neither willing to run 'bus services of its own nor to let anyone else run them. The inquiry was adjourned.

Main-line Railway Electrification.—GOVERNMENT COMMITTEE.—The Minister of Transport makes the following announcement:—The Government has had under consideration the advisability of obtaining a report upon the problem of the electrification of the main-line railway systems of Great Britain. A Committee has accordingly been appointed consisting of: Lord Weir of Eastwood (chairman), Sir Ralph Wedgwood, C.B., C.M.G., and Sir William McLintock, K.B.E., C.V.O., with the following terms of reference: "In view of the progress which is being made towards widespread availability of high tension electrical energy, to examine into the economic and other aspects of the electrification of the railway systems in Great Britain, with particular reference to main-line working, and to report their conclusions." The secretary to the Committee will be Col. A. H. C. Trench, R.E., C.I.E., M.I.E.E., Ministry of Transport, 6, Whitehall Gardens, S.W.1.

It is stated that the appointment of this Committee will in no way interfere with, or delay, any particular schemes of suburban or other electrification which may be otherwise under consideration. Lord Weir presided over the Committee which was appointed in 1925 to review the national problem of the supply of electrical energy, whose report led to the Electricity (Supply) Act, 1926, and the establishment of the Central Electricity Board. Sir Ralph Wedgwood is the general manager of the London and North-Eastern Railway, and Sir William McLintock, who has advised the Government on many matters, was appointed by the Ministry of Transport to be the auditor of the Central Electricity Board. Colonel Trench is one of the Inspecting Officers of Railways under the Ministry of Transport.

Manchester.—TRAMWAY PROPOSAL REJECTED.—The Corporation Tramways Committee has decided that the proposal to construct a tramway in Moston Lane shall not be proceeded with.

NOISY TRAMCARS.—The general manager of the Corporation tramways has prepared a report on the subject of noise in relation to the working of tramways, with a view to reducing the noise caused by the running of tramcars in the city.

LOAN.—The Tramways Committee has been authorised by the City Council to borrow £25,500 for the construction of new tramways in Thompson Street and Aytoun Street.

Siam.—RAILWAY ELECTRIFICATION.—The Siamese Government has decided to electrify the railway lines around Bangkok. The programme sanctioned includes about 150 kilometres (93 miles), of which 90 are on the Northern line and 48 on the Southern. There is a Government power station under the control of the Royal State-Railways Department, but the scheme now sanctioned will require its complete reconstruction.—*Reuter's* (Bangkok).

Stockton.—RAILLESS TRACTION.—The Town Council is to invite the Corporations of Thornaby and Middlesbrough to discuss the question of abandoning the tramway system and substituting railless cars or 'buses between the towns.

Sunderland.—TRAMWAY EXTENSION.—The Tramway Committee has decided to recommend the Town Council to agree to an extension of the tramway track in Roker Park Road for the purpose of speeding up the service to and from the Roker Park football ground. The length of the new track will be about 200 yards.

Telegraph and Telephone Notes.

Colombia.—Telephone Statistics.—According to a recent return there are now 18,974 miles of telegraph wires in operation in Colombia, or 2.6 miles per 1,000 of population. The number of telephone instruments in use in the country is given as 18,875, or approximately 2.6 for each 1,000 inhabitants.

Empire Radio-telephony.—Opening of Sydney Service.—On September 3rd, to mark the opening of the new radio-telephone service between London and Sydney, Lord Passfield, Secretary of State for Dominion Affairs, held a conversation with Mr. Stanley Bruce, the Australian premier. Both speakers expressed their satisfaction with the service, stating that every word could be heard distinctly. Mr. Bruce said that the success of the system was calculated to foster closer relations between the Governments of the Empire.

Germany.—Picture Transmission Service.—A picture telegraph service has recently been established between Germany and Sweden.

Italy.—German Telephone Cables.—The Siemens and Halske Co., of Berlin, which recently completed a telephone cable between Rome and Naples for the Italian Post and Telegraph authorities, has lately secured a contract for a 262-mile cable in Northern Italy between Poggio-Renalico, near Bologna, and Trieste, with a branch at Cussignacco to Tarvis on the Austrian frontier.

New Zealand.—High Percentage of Telephone Subscribers.—The annual report of the Postmaster-General shows that there are 152,541 telephones in service in New Zealand, which is an average of 10.3 for every hundred of the population. This figure is exceeded only by the United States and Canada.—*Reuter* (Wellington).

Russia.—The Farthest North Wireless Station.—The most northerly wireless and meteorological station in the world, operating on a 43-metre wavelength, has been established at Tranquil Bay in Franz Josef Land in the Arctic by a Soviet expedition. The expedition reached Franz Josef Land in the Soviet icebreaker *Sedov*, which has now returned to Russia by way of the Barents Sea. Commander Schmidt, the leader of the *Sedov* expedition, declares that the meteorological and wireless stations are equipped with the most up-to-date instruments. A number of building are now being constructed for the first Soviet colonists in the country. During the explorations, the *Sedov* reached 82.14 N., thus breaking the record for navigation in northern latitudes.—*Reuter* (Moscow).

Sweden.—Rapid Telephone Development.—The telephone system in Sweden is developing very rapidly. In the years 1924-27 the number of new subscribers was about 15,000 every year; in 1928 it rose to 18,000, and in 1929 is expected to reach 20,000. The Telegraph Board considers that another telephone cable to Germany will be needed next year, as Continental and British communications *via* Germany are steadily increasing, and another telephone cable to the Island of Gotland is planned.—*Reuter's Trade Service* (Stockholm).

The Cable-Wireless Merger.—Completion of Purchase.—Imperial and International Communications, Ltd., announces that the purchase of the Imperial cables has been completed and the lease of the beam wireless stations taken up by the company. The other necessary agreements in connection with the cable-wireless merger have been exchanged with the Government, and it is anticipated that the Imperial cable and beam wireless services will be operated by the Communications Company at an early date. These arrangements are in accordance with the recommendations of the Imperial Wireless and Cable Conference for the unification of the telegraph services of the Empire.

United States.—Telephoning in Mid-Air.—The *Telegraph and Telephone Age* reports that a parachute jump from an airplane at a height of 10,000 feet was made at Roosevelt Field, N.Y., on August 12th by Mr. H. Bushmeyer, who carried a short-wave radio set, weighing twenty pounds, and on his way down talked with another short-wave station which had been set up on the field. It took Mr. Bushmeyer nine minutes to reach the earth, and he was in constant communication with the ground station, except during the last 3,000 feet, when the antenna of his radio set got entangled with his legs and broke.

Radio Notes.

Australia.—Broadcasting Company's Plans.—*World-Radio* publishes a report of an interview with Mr. H. P. Brown, Director of Postal Services in Australia, in which the future plans of the Australian Broadcasting Company are discussed. The company aims at providing an adequate service for 90 or 98 per cent. of the Australian population. Within twelve months suitable telephone lines will connect Perth with Melbourne and Sydney, and, later, Tasmania will be linked with the mainland by means of duplex and broadcasting channels. It will then be possible to broadcast a programme simultaneously in each of the capital cities. The first relay station is to be built at Newcastle (N.S.W.) and eleven or twelve other relay stations will be erected in various parts of the continent. At present the company is operating the 2FC and 2BL stations in Sydney and the 3LO station in Melbourne, and the initial programmes are said to have been excellent. Experiments with the Fultograph picture-transmission system have to be carried out and as soon as the formal permission of the P.M.G. is received regular transmissions will be made from 2FC and 3LO.

Continental.—New Short-wave Stations.—Three new short-wave stations were noted in the last issue of *World-Radio*. The first of these is at Motala (Sweden) which employs a wave-length of 99 metres (3,030 kc.) and relays the Stockholm programmes. A station at Colthen (Germany), transmitting on 43.6 metres (6,881 kc.), is still in the experimental stage. The latest station is that at Zeesen, near Königswusterhausen, which began transmitting on August 26th with a wave-length of 31.38 metres (9,560 kc.) and will continue to relay the Königswusterhausen programme daily from 8 p.m.

The Regional Scheme.—Brookman's Park Station.—The London regional transmitting station at Brookman's Park is now complete, and preliminary test transmissions on 2LO's normal wavelength of 356.3 metres (842 kc.) will begin on Monday, September 16th, after the close of the ordinary London programme. Primarily designed for the provision of an alternative programme service, this station consists of two separate high-power transmitters. The alternative programme, however, will not be introduced until such time as listeners have become accustomed to receiving the single programme service from the new station.

The schedule of preliminary transmissions will be as follows:—Starting on Monday night, September 16th-17th, a few minutes after the close of the London programme, there will be a test transmission of music for one hour every night for a fortnight, excluding Sundays. On and after Monday, September 30th, the last section of the London programme, which is usually dance music, will be transmitted from the new station every night for two or three weeks, excluding Sundays. Notice will be given later of the date on which Brookman's Park will take over the service entirely.

The new station will serve a very much larger area than the present Oxford Street transmitter, and eventually there will be a service of alternative programmes to all living within 80 to 100 miles of Brookman's Park who own suitable valve sets, while it is anticipated that crystal set users will have no difficulty in receiving the station up to an average distance of 50 miles, if a good outside aerial can be erected.

Listeners living within a radius of three to six miles of Marble Arch will find that the strength from the new station will be appreciably less than that to which they have been accustomed, and it is probable that reception on crystal sets may be weak, unless all the components, including the aerial, are in sound condition. The B.B.C. has prepared a pamphlet called "Crystal Sets and the Brookman's Park Transmitter," which is written with the object of assisting listeners whose reception will be affected by the change-over to the new station. The pamphlet is obtainable on request from the B.B.C., Savoy Hill, W.C.2.

Electricity in Northern Ireland.

That there is a growing interest in the development of the public supply of electrical energy throughout Northern Ireland is evidenced by a report just issued covering the activities of the Ministry of Commerce and the Electricity Commissioners for Northern Ireland under the Electricity Acts. The report deals in some detail with applications for Special Orders, the establishment of new and the extension of existing generating stations, the construction of main transmission lines, and borrowing by local authorities for electricity purposes. Appendices to the report show the stage of development attained by undertakings giving public supplies of electricity under statutory powers, the capital expenditure and working costs of the various statutory undertakings, together with the fuel consumption, load factor and sales of current under various headings. A notable feature in the record of the year's working is the increase in the electrical energy sold by the Belfast Corporation undertaking, 56,212,857 kWh having been sold in the year ended March 31st, 1927. An appendix shows in graphical form the growth of the sales of electricity in Northern Ireland during the years 1924 to 1927. The report mentions that, while the average consumption in Northern Ireland had increased in 1927 to 47 kWh per head of population, such a figure is still considerably below the average rate of consumption in Great Britain. Reference is made to the powers granted by Parliament to the Antrim Electricity Supply Co. for the generation of electrical energy on the lower River Bann.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Argentina.—BUENOS AIRES.—November 4th. Argentine State Railways. Turbo-generator sets and head lights for locomotives. (B.X. 5657).*

Australia.—MELBOURNE.—State Electricity Commission. October 7th. 11,000-V three-phase cable. (B.X. 5539.)*
November 4th. 6,600-V automatic voltage regulators and spares. (B.X. 5637.)*
November 25th. Watthour meters, recording instruments, and remote metering equipment. (B.X. 5614.)* Switchgear and accessories for the Yallourn power station. (B.X. 5636.)*
October 1st. Posts and Telegraphs Department. Switchboard cords. (B.X. 5515.)*
October 8th. Telephone relays. (B.X. 5655.)*
October 15th. Switchboard instruments, test plugs, and sleeves. (B.X. 5541.)*
October 22nd. Telephone transformers (B.X. 5581).* Insulated wire (B.X. 5580.)*
November 12th. Telephone receivers and parts. (B.X. 5656).* Transmitters and parts. (B.X. 5653).*
October 30th. City Council. Two 2,500-kW motor convertors and accessories or, alternatively, two 2,500-kW rotary convertors, with transformers and accessories. (B.X. 5570.)*
October 23rd. Victorian Railways. Dry-core telephone cable. (B.X. 5638).*
SYDNEY.—City Council. October 2nd. 6,600-V metal-clad switchgear for Argyle sub-station (spec. No. 858, 2s. 6d. each); 2,200-V ironclad switchgear for Town Hall sub-station (spec. No. 856, 2s. 6d. each); 1,500-V switchgear for Argyle sub-station (spec. No. 857, 2s. 6d. each). Chief Engineer, 61, Hunter Street, Sydney.

Belfast.—September 16th. Electricity Department. Overhead travelling cranes. (See this issue.)

Birkenhead.—September 24th. Mersey Railway. Electrical sundries, lamps and fittings. Forms of tender from Mr. J. Shaw, general manager and secretary, Central Station, Birkenhead.

Edinburgh.—September 28th. Midlothian and Peebles District Asylum. Electrical fittings, for six months. Mr. C. L. Addison-Smith, clerk and treasurer, 19, Heriot Row, Edinburgh.

Edmonton.—September 16th. Board of Guardians. Six months' supplies of X-ray, light, massage, &c., requisites and electric lamps. Forms of tender from Mr. E. Ridley, clerk to the Guardians, 77, Bridport Road, Edmonton, N.18.

Egypt.—October 16th. Ministry of the Interior. Electric motors, pumps, mechanical filters, &c. (A.X. 8373.)*
October 2nd. Electrical power station for Dessouk (Gharbieh Province). (B.X. 5597.)*
October 1st. Supply and erection of a 500-kVA power station, with underground and overhead networks, for the town of Menouf. (B.X. 5567.)*
October 10th. Supply and erection of a generating station for Tala. (B.X. 5647.)*

Exminster.—September 20th. Committee of the Devon Mental Hospital. Supply for a period of six months of electric lamps, &c. Specifications from Mr. Cecil Masters, clerk.

Halifax.—October 7th. Waterworks Committee. Electrician's work in connection with the erection of filter house, &c. Particulars from Mr. A. C. Tipple, borough engineer (deposit £2 2s.).

Hastings.—October 3rd. Electricity Department. 11-kVA metal-clad switchgear and one 5,000-kVA outdoor type transformer. (See this issue.)

Horsham.—September 27th. Electricity Department. 125-kW rotary convertor, step-up transformer, two draw-out truck-type e.h.p. switch units. Sub-station equipment. Two 100-kVA transformers. E.h.p. switchgear, l.p. switchboard and cable work. One e.h.p. feeder cable. (See this issue.)

India.—October 11th. South Indian Railway Co., Ltd., Madras. Electrification of suburban services, overhead contact and distribution lines. (See this issue.)
October 2nd. India Store Department. 20,000 sac elements, No. 1 size. (August 30th.)
September 25th. 200,000 telegraph insulators, porcelain and composition. (See this issue.)

Kettering.—September 9th. Electricity Department. H.p. armoured cable. ((September 6th.)

London.—METROPOLITAN ASYLUMS BOARD.—October 2nd. Installation of electric bells at Paddington Casual Ward; new storage battery for T.S. *Exmouth*; alterations to electric lighting installation at Eastern Fever Hospital. (August 30th.)
September 24th. H.M. Commissioners of Works. Steam generating set, control panel, &c. H.M. Office of Works, King Charles Street, S.W.1.
SOUTHWARK.—October 22nd. Borough Council. Electric cables for 12 months. (See this issue.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. October 30th. Head telephone receivers. (B.X. 5603.)*
Corporation. September 30th. Electric motors, starters and switchgear for the Milk Department. (B.X. 5508.)*
October 21st. H.p. and l.p. switchgear. (B.X. 5649.)*
December 10th. Public Works Department. Three single-phase oil-insulated water-cooled transformers and accessories. (B.X. 5600.)*
October 8th. Electric ranges, radiators, and water-heaters. (B.X. 5642.)*
AUCKLAND.—September 23rd. Auckland Electric Power Board. Pilot cable and joint boxes. (B.X. 5643.)*
November 4th. L.p. porcelain insulators, ironwork, &c. (B.X. 5648.)*

Rochdale,—September 18th. Electricity Department. A.C. single-phase house service and prepayment meters for 12 months. (September 6th.)

Salford,—September 23rd. Electricity Department. One 10,000-kVA, 33-kV transformer for outdoor service at Trafford sub-station. (September 6th.)

South Africa.—JOHANNESBURG.—October 17th. South African Railways and Harbours. One 10-ton electrically-driven overhead travelling crane. (A.X. 8463.)*
October 17th. Municipal Council. Supply of tramcar motors. (B.X. 5,664.)*
SALISBURY.—October 17th. Municipal Council. H.p. cables, transformers, &c. (B.X 5604.)*
Turbo-alternators, steam piping, crane and switchgear. (B.X. 5607.)*
CAPE TOWN.—October 16th. Electricity Department. Paper insulated cables. (B.X. 5640.)*

Warrington.—September 21st. Board of Guardians. Electrical supplies for six months. Mr. Arthur Bottomley, clerk, Museum Street.

West Ham,—September 16th. Education Committee. Installation of electric lighting and water-heating apparatus at Plaistow secondary school now in course of erection. (August 16th.)

Wigan.—September 16th. Board of Guardians. Electrical engineering sundries for six months. Matron, Frog Lane Institution, and steward, Billinge Infirmary, Orrell.

Wolverhampton.—September 27th. West Midlands Joint Electricity Authority. Supply and erection of a double-circuit 33,000-V, 3-phase, 50-cycle overhead (steel tower) transmission line. (August 30th.)
September 26th. Education Committee. Installation of electric light and power at the Wolverhampton Grammar School. (August 30th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Abertillery.—Urban District Council. Accepted:—
E.h.p. switchgear.—A. Reyrolle & Co., Ltd.
Transformer (Hackbridge) and l.p. switchgear.—Electric Construction Co., Ltd.

Birkenhead.—Electricity Committee. Accepted:—
Cable (£2,053).—Hackbridge Cable Co., Ltd.; Macintosh Cable Co., Ltd. (£2,783).

Bolton.—Tramways Committee. Accepted:—
Electrical fittings, boiler, and cooker for 'bus garage.—Corporation Electrical Fittings Department.

Gainsborough.—Urban Council. Accepted:—
Electrification of the river pumping plant (£438).—Worthington-Simpson, Ltd.

Glasgow.—Housing Committee. Recommended:—
Electrical installations at various housing schemes (£396, £899, and £1,355), R. J. McIntyre; and (£651), D. Henderson.
Baths Committee. Recommended:—
Electrical work at new baths at Plantation.—T. B. and J. A. Mathieson, Ltd.
Tramways Committee. Recommended:—
⅜-in. insulated bolts.—British Insulated Cables, Ltd.
Storage battery for Bearsden sub-station.—Hart Accumulator Co., Ltd.
Armature coils.—Dyer & Young, Ltd.
D.c.c. wire.—Callender's Cable and Construction Co., Ltd.
Cleansing Committee. Recommended:—
Installation of additional battery-charging plant for the garage of the new destructor works at Govan.—Overhead charging feeder system (£349), battery charging plant (£19,443).—Fraser & Borthwick, Ltd.
Electrically-operated swing jib wall crane and bogie (£99).—J. Deas & Co.

London.—ADMIRALTY.
Electrodes for 12 months.—Alloy Welding Processes, Ltd.
GENERAL POST OFFICE.
Electric lamps for 12 months.—Siemens Electric Lamps and Supplies, Ltd.
SOUTHERN RAILWAY.
Electric lamps for 12 months.—Siemens Electric Lamps and Supplies, Ltd.

Luton.—Tramways Committee. Accepted:—
Covered tops for three tramcars (£1,065).—Brush Electrical Engineering Co., Ltd.

Manchester.—Education Committee. Accepted:—
Electrical installation at Aspinal municipal school.—John Adams, Ltd.
Tramways Committee. Accepted:—
Special track work.—Edgar Allen & Co., Ltd., and Titan Trackwork Co., Ltd.

Uttoxeter.—Urban Council.
Contracts accepted in connection with the electricity scheme.—(£12,607) Power Lines Construction Co., Ltd.; (£1,480) Crompton Parkinson, Ltd.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—
"STAYBRIGHT" outside fittings.
"A.C.D." hair dryer.

Notes.

The Blackburn Appointment.

In our advertisement pages to-day will be found an "Official Notice" by the Blackburn Corporation inviting engineers to apply for the post of engineer and manager of the electrical undertaking. It will be understood that this is in order to fill the vacancy created by the dismissal of Mr. P. P. Wheelwright under circumstances which are reported on pages 460-462 of this issue of the ELECTRICAL REVIEW. It is noteworthy that the N.A.L.G.O., and the A.M.E.E. both used their influence on behalf of Mr. Wheelwright, who had been 25 years in the service of the Corporation. In the closing speech, Ald. Hamer, as will be observed, said that he felt that the information placed before them did not justify dismissing a man who had held a high position for 25 years.

National Physical Laboratory Report.

The annual report of the National Physical Laboratory for 1928 may be obtained either in volume form, or divided into the following separate phamplets, which are issued by H.M. Stationery Office:—

	Price. s. d.
(1) The Units and Standards of Measurement Employed at the National Physical Laboratory	1 0
(2) Report on the Physics Department	1 9
(3) Report on the Electricity Department	3 0
(4) Report on the Meteorology Department	2 0
(5) Report on the Engineering Department	1 9
(6) Report on the Aerodynamics Department	1 6
(7) Report on the Metallurgy Department	1 6
(8) Report of the Advisory Committee for the William Froude National Tank	0 4

It is hoped in this way to render the results of the work of the Laboratory more readily available.

The B.B.C. and Television.

The British Broadcasting Corporation has offered the Baird Television Development Co. the opportunity of using one of its stations for experimental purposes during five half-hourly periods per week. The transmissions, of course, would take place outside the normal broadcasting hours. Although the Television Co. still considers the time allotted to be inadequate, it is believed that it will accept the offer.

Appointments Vacant.

Visiting teacher of electrical design for Wednesday evenings for the Goldsmiths' College, New Cross. Senior shift engineer for the Government of the Bahamas. Electrical engineer and manager for Blackburn Corporation. Assistant sub-station attendant for Stoke Newington Borough Council. Sales engineer for Bedford Corporation. Plant engineer, engineer conversant with automatic and manual exchange apparatus, and two workshop foremen for the Shanghai Mutual Telephone Co., Ltd. (See our advertisement pages to-day.)

Overhead Lines Association.

The annual general meeting of the Overhead Lines Association will be held on Wednesday, October 16th, at 5.30 p.m., at the Institution of Electrical Engineers, Savoy Place, W.C.2. by kind permission of the Council of the Institution.

Bearing Lubrication in Automatic Sub-stations.

In manually operated sub-stations, a fairly even temperature is maintained by the attendant by opening or closing doors, windows or ventilating equipment or stoking a boiler. In automatic sub-stations, however, openings for ventilation are fewer, heating equipment is unnecessary, and, with no attendant available, extremely high and low operating and room temperatures are encountered. With the installation of automatic control, the problem arose of furnishing the bearings during summer months with a heavy viscous oil, and then removing and storing this oil in the fall in order to supply bearings with a less viscous oil for winter use.

SUMMARY OF CONVERTOR BEARING TEMPERATURE TESTS.

Time	Room Temperatures, Deg. C.	Bearing Temperature Ordinary Oil, Deg. C.	Bearing Temperatur e Treated Oil, Deg. C.	Temperature Difference, Deg. C.
9:00 a.m.	27	40	32	8
9:15 a.m.	27	45	34	11
9:45 a.m.	27	47	35	12
10:00 a.m.	27	48	35.5	12.5
3:30 p.m.	28	54	39	15
4:00 p.m.	29	54	39	15
4:30 p.m.	29	54	39	15
5:00 p.m.	29	54	39	15

Many tests were made to discover an oil the viscosity of which changed but little between temperatures of 0 deg. F. and 160 deg. F. Such an oil finally was obtained and temperature tests were made, showing an average reduction in running temperature of 15 deg. C. in favour of the new oil. This oil, a treated product containing a proportion of edible tallow, will function in extreme temperatures with a viscosity change of only 2 per cent.—*Elec. Railway Journal*, September, 1929.

New Colliery Plant.

Apart from a complete reorganisation of the Chislet (Kent) Colliery to cope with an output of 2,000 tons per day, some time ago two 1,000-kW turbo-alternators were installed to provide electric power for driving main and tail and endless rope haulages, as well as a large main pumping set underground, all of which were previously operated by compressed air.

Direct Current.

A correspondent who adopts the apt pen-name of "Phase Angle" sends us the following extract from *Country Life* dated August 31st:—

"*Electrified Scenery.* . . . Moreover, a power line cannot easily be diverted. The force that it carries knows nothing of human tastes, and tries to follow a straight course, or at most, a very gradual curve. To bend a power line in an angle of 60 or less, a box or tower has to be constructed in which the current is so treated as to deflect its course. As these towers are heavy and conspicuous objects it is to everyone's interest that the angles should be as slight as possible."

Wood-pulp Cable Paper Subjected to Heat Only.

A complete report on an investigation of manilla paper was published in the 1924 annual report of the N.E.L.A. Underground Systems Committee. A final report, which included some supplementary data, appeared in the A.I.E.E. *Journal* for May, 1925, and also in the general serial report of the N.E.L.A. Underground Systems Committee in 1927, which included a report of a similar investigation of wood-pulp paper insulation.

The results of the latter series of tests showed that a more extensive investigation of wood-pulp paper insulation should be made, with a larger number of samples over a longer period. A new series of tests was consequently started in 1926, and the complete final report (Report No. 3) was rendered by the Institute on March 15th, 1928.

Tests performed on wood-pulp paper, as used by representative American cable manufacturers, gave erratic results, which were expected from previous tests of this type.

Power factor tends to increase very gradually, except for occasional large changes of apparently accidental character,

but no comparison with previous results is possible because these are the first power-factor curves obtained in the research.

The average of all samples at room temperature shows that large changes in mechanical strength occurs at 20 deg. C., but the paper recovered to almost its original value. Certain samples, however, did not fully recover.

The average at 50 deg. C. and 70 deg. C. show almost the same results as for 20 deg. C., except that folding endurance drops faster than tensile strength at 50 deg. C. and 70 deg. C., and *vice versa* at 20 deg. C. The paper regained almost its original state by the end of the test.

At temperatures of 90 deg. C., steady, 90 deg. C., intermittent, and 100 deg. C., definite deterioration occurs in all mechanical tests without recovery. The puncture voltage remains almost constant. The tearing strength decreases.

There is practically no difference between deterioration at a temperature of 90 deg. C., continuously applied, or intermittently applied.

Mechanical deterioration is very rapid at 140 deg. C. Complete destruction is reached, after a short time, and puncture voltage does not decrease as rapidly or as completely.

The tests did not disclose any consistent or definite difference in the rate of deterioration as measured by mechanical tests for temperatures from 20 deg. C. to 100 deg. C. The puncture voltage is practically constant, with a tendency to increase rather than decrease.

The combined average of all mechanical tests, compared with the corresponding curves made on manilla paper in 1924, show that the trend is fairly constant, downward, for a few weeks, and then at the lower temperatures (20 deg.-70 deg.) it is upward, to recover over one-half of the loss after 45 weeks. The 90 deg. C. and 100 deg. C. curves continue downward.

Wood-pulp paper at temperatures up to 70 deg. C. deteriorates faster than manilla paper at 100 deg. C. At 100 deg. C. the wood-pulp paper does not deteriorate as rapidly as the manilla paper. At 140 deg. C. wood-pulp paper is very superior to manilla paper.

Summarising the results, it is believed that the rate of deterioration of wood-pulp paper is no greater, after the first few months, than that of manilla paper. Curves plotted suggest that cable could be operated indefinitely at 100 deg. C. so far as mechanical strength is concerned with a loss of only about 30 per cent. The flattening effect should, however, be confirmed by still longer tests which include manilla paper. The very definite recovery characteristics at lower temperatures are worthy of further investigation. The conclusion is drawn that wood-pulp paper, properly treated, can be operated at as high temperatures and give as long life as manilla paper.

Safety in Mines Research Board.

The seventh annual report (for the year 1928) of the Safety in Mines Research Board has just been published (H.M. Stationery Office, price 1s. net). The report gives an account of the progress during the year of the researches which are being carried out directly under the board, or by other bodies in collaboration with them, and also the researches carried on at other centres with the aid of financial assistance from the Board.

The subjects of research, which are treated rather more fully than in previous annual reports, include problems relating to coal dust and firedamp explosions, the spontaneous combustion of coal, the safe use of electricity and explosives, safety lamps, falls of ground, wire ropes, mine rescue apparatus, and mine temperatures.

The report also embodies an account of the progress of the health inquiries carried out under the supervision of the Health Advisory Committee, notably those into the effects of dust inhalation.

A Belgian Electrical Museum.

As a result of the efforts of M. Charles Mourlon and the Chambre Syndicale des Electriciens de Belgique, an electrical museum has recently been established at the Palais du Cinquantenaire, Brussels, with the object of demonstrating to the public the great advance that has been made in applications of electricity, and the part Belgium has played in such development. The museum occupies two rooms of the Palais, in one of which is a restrospective collection of telegraph and telephone instruments arranged by the Belgium Post and Telegraph authorities, the walls of the room being hung with statistical tables and portraits of Belgians who have assisted in telegraphic and telephonic progress. In the second room there is a complete display of traction appliances for electric tramways; of accumulators of all types, incandescent lamps, and a historical collection of dynamos, the latter having been presented by the Belgian State Railway authorities. A feature of the room are drawing and models of the early dynamos of Gramme, of the early accumulators and dynamos of the brothers Pieper, and of the dynamo and miner's safety lamp of Dulait. Finally, the museum includes the wireless apparatus first developed by the Société Belge de T.S.F. and the first set used in the Belgian Congo.

Libraries and Information Bureaux Conference.

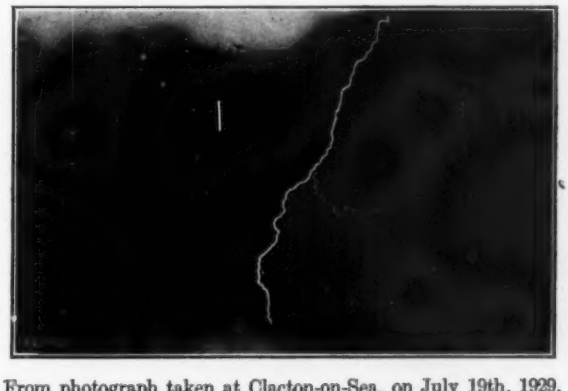
The annual conference of the Association of Special Libraries and Information Bureaux is to be held at Trinity College, Cambridge, during the week-end commencing Friday, September 20th. Full particulars can be obtained by those interested from the Secretary, A.S.L.I.B., 26, Bedford Square, London, W.C.1.

Emissions from Klingenberg Power Station, Berlin.

The Berlin Correspondent of *The Times* states in the issue for September 6th, 1929, that the Berlin Electricity Company has now replied to the request made by the London County Council for information as to its experience in combating the smoke, ash, and sulphur fumes nuisance at its Klingenberg power station. It is stated that Klingenberg, a station of 270,000 kW, is hardly comparable with the proposed Battersea station, as it is not situated in a populous suburban area, but in a thinly inhabitated district on the south-eastern outskirts of Berlin. In its reply, the Berlin Electricity Company pointed out that there had been practically no complaints in regard to sulphurous fumes and that no harmful effects, either upon the health of the population or upon vegetation, had been remarked. The nuisance arising from this source has been little noticed at Klingenberg, although there are, of course, few buildings in the neighbourhood. The deleterious effect upon vegetation, as stated, is difficult to detect with the naked eye. The question of neutralising the fumes has not, therefore, become acute, although it is, of course, receiving continual attention. The coal used has a comparatively low sulphur content, and it is thought that the coal used in England may possibly have a higher one. The German engineers believe the best solution of this problem to lie in higher chimneys; a new station now being built between Siemenstadt and Spandau is, therefore, to have chimneys nearly 400 ft. high, whereas those at Klingenberg are only 225 ft.

On the other hand, there have been many complaints from neighbouring inhabitants, owners of cafés, and holiday-makers on the Spree about the floating ash and grit discharged from the chimneys, which on gusty days have descended in showers and caused much annoyance. The Klingenberg station uses pulverised fuel, which has a high ash content, and this nuisance has been attacked by the installation of ash-catchers, electric-filters, and Davidson "cyclones," which are estimated to trap some 80 per cent. of the total ash content. Experiments are also being made with a "water-washing process," in which the waste gases are forced through several "veils" of water. It is believed that these will retain a very large proportion of the ash and of the gases, and it is also thought that it may prove possible to trap part of the sulphur fumes in the same way.

A Lightning Flash.



From photograph taken at Clacton-on-Sea, on July 19th, 1929, by Mr. H. Edney, of the Engineering Staff of Messrs. W. T. Henley's Telegraph Works Co., Ltd.

Educational.

WILLESDEN POLYTECHNIC INSTITUTE.—Courses are held in electrical engineering, elementary and advanced, and also in electrical installation work, under the new scheme of the City Guilds as approved by the Institution of Electrical Engineers and the Electrical Contractors' Association. An exhibition of students' work, to be opened by the Lord Mayor of London, will be held during the week commencing September 16th. Admission free.

BATTERSEA POLYTECHNIC.—Full time day courses and evening courses in electrical, mechanical, automobile and civil engineering. (See our advertisement pages to-day.)

HACKNEY TECHNICAL INSTITUTE.—ELECTRICAL ENGINEERING DEPARTMENT.—Evening classes are held in electrical technology, electrical machinery, electrical power supply, electrical power control and measurement, power plant and combustion engineering, protective gear, electrical installation work, &c. Classes reopen September 23rd. Full particulars can be obtained from the Institute. (See our advertisement pages to-day.)

Northampton Engineering College, St. John Street, London, E.C.1.—The 1929-30 session commences on October 2nd.

Northampton Polytechnic Institute, St. John Street, London, E.C.1.—Evening classes commence on September 23rd. The Polytechnic will be open for enrolment each evening, except Saturday, the previous week.

E.D.A. Conferences.

From a preliminary notice issued by Lt.-Col. W. A. Vignoles we learn that arrangements have been made for a series of E.D.A. Salesmanship Conferences to be held at the Royal Society of Arts, John Street, W.C.2, during the session 1929-

1930 on the third Friday of each month from October, 1929, to March, 1930, inclusive; conferences will commence at 7.30 p.m. prompt. The first three conferences will be as under :—

October 18th, "Personal Salesmanship in the Electrical Industry," by Miss G. Burlton, B.A. Chairman : Sir Andrew R. Duncan, M.A., LL.D.

November 15th, "Selling Time Switches," by Mr. E. E. Sharp. Chairman : Sir John R. Brooke, C.B.

December 20th, display of kinematograph films.

A complete programme for the whole of the series will be issued during the next week or two.

E.A.W. Publication.

The Electrical Association for Women has published (price 1s.) in booklet form, under the title "What Women think about Electrical Development in Great Britain, U.S.A., Holland, and Germany," a report of the proceedings of the fourth annual Conference of the Association held at the North-East Coast Exhibition, Newcastle-on-Tyne, July 10th-12th, 1929 (Electrical Review, July 26th, p. 149).

The Model Engineers' Exhibition.

The Small Power, Engineering, Electrical and Scientific Exhibition, which was opened on September 7th at the Royal Horticultural Hall, S.W., and concludes on Saturday next, revealed as in previous years, some wonderful examples of the art of model makers, and included electric motors, dynamos for house lighting, wireless batteries, transformers, switchboards, &c. In addition to stationary and locomotive steam engines, there are many clever replicas of electric locomotives. The number of stands showing models, tools, &c., is 46. Two features which are attracting considerable interest are a working model, electrically-operated, of the Lord Mayor's show of 1616, passing along a picturesquely-modelled portion of old Cheapside, and "Eric," the famous Robot, who, under the direction of his inventor, Captain W. H. Richards, makes speeches and answers many questions. For the model-making competition organised by the proprietors of the *Model Engineer*, there have been 223 entries. The exhibition, which is organised by Messrs. Percival Marshall & Co., has attracted a large number of young visitors—and their elders.

Fatality.

Sheriff J. Dean Leslie recently conducted an inquiry at Stirling into the death of David Orr, motor haulage man, who received a fatal electric shock in No. 2 Pit, Polmaise Colliery, Millhall. The under manager stated that Orr's duties were to attend to the controller of the electric haulage. He had inspected the main switch and found that the small tank containing oil in which the live contacts were situated was hanging loose at one end. There was a piece of skin adhering to one of the live contacts. William Jerome, electrician, gave evidence as to the working of the engine at which Orr met his death. He stated that the voltage was 550. Frank Kennedy, assistant electrician, said the electrically-driven haulage engine had been installed about six weeks previous to the accident. The last day on which witness examined the engine prior to the accident was July 12th, when everything was found correct. After the accident he found that the main switch had been switched off, while the oil tank was hanging by one screw. Three of the live contacts were exposed. Witness made a test for leakage of current at the engine, but found none. A formal verdict was returned.

Legal.

Companies Act Prosecution.—The *Financial Times* reports that at Bow Street Police Court, on September 6th, before Sir Chartres Biron, two brothers, Charles William Morgan and Augustus Morgan, were fined £20 and £15 15s. costs for failing to register their office, contrary to the provisions of the Companies Consolidation Act, 1908.

Defendants were fined a further £10 each for carrying on business under the title of the Holborn Warehouse Company, Ltd., for four months without being registered, and Charles William Morgan was fined £10 for failing to notify that he carried on a separate business—the Central Electric Company—at the same address as the Holborn Warehouse Co., Ltd.

County of London Co. Summoned.—The *South London Press* states that the County of London Electric Supply Co., Ltd., was summoned at Lambeth Police Court recently for a breach of the electricity regulations under the Factory and Workshop Act, 1901, by reason of which, it was alleged, an employé, Peter J. Morgan, suffered bodily injury.

Mr. G. D. Roberts, who appeared for the Director of Public Prosecutions, said that the company had a small transformer station on a consumer's premises at Rye Lane, Peckham, working at 2,000 V. On May 11th, Morgan, who was a competent workman, was given instructions to fix a small meter on the switchboard at that station. The switchboard could have been made entirely safe by disconnecting the supply at Camberwell, but that would have been inconvenient to the company, because it would have meant cutting off the power to five sub-stations. Morgan, on May 12th, was working at the switchboard with a live terminal within 15 in. on each side of him. A rubber screen might have been used, and might have protected Morgan from the live terminals. In the course of the work Morgan's right arm came into contact with a live terminal, and he was severely burned, necessitating his being two months in hospital.

Mr. Percival Wood, district mains engineer to the company, answering a question, said he gave definite instructions that the terminals should be screened. If that had been done the accident would not have occurred. The part of the switchboard Morgan was working on was absolutely dead.

Morgan said he asked if the terminals were to be made dead, and Mr. Cassals shook his head. Nothing was said about the use of screens.

Cross-examined, Morgan agreed that if the terminals had been screened the accident would not have happened. At the time it occurred he was not wearing rubber gloves. He had taken them off because they were inconvenient for the work he was doing.

Other evidence having been given, the further hearing of the case was adjourned.

Mining Electrical Engineers.

The South Wales Branch of the Association of Mining Electrical Engineers held its first meeting of the 1929-30 session on September 7th, the vice-chairman, Mr. Dawson Thomas, Abertillery, presiding. Mr. D. Farr Davies, deputy chairman of the Monmouthshire and South Wales Coal Owners' Association, presented the gold medal awarded by the Association for the best paper read before any branch to Mr. S. B. Haslam for his paper on "Modern methods of firing steam boilers, with special reference to pulverised fuel." The first branch prize took the form of a handsome time-piece, which was awarded Mr. F. E. Pring, of Varteg Pontypool, for his paper on "Coal-cutting Machines in Low Seams." The Association's certificates for successful candidates who sat for the 1929 examinations were presented to Mr. B. J. Burkle, Blackwood (first), and Mr. W. T. Gay, Cwm (second).

The incoming branch president, Mr. W. W. Hannah, then took the chair and in his presidential address, reviewed briefly some aspects of the present position with regard to the use of electricity in the mines of South Wales. It was pointed out that there was still a large margin in colliery load curves suitable for municipal and other supplies and it would be interesting to see if the Electricity Commissioners' plans for that area would result in co-ordination between private stations and the supply authorities.

Referring to this aspect of the subject, Mr. D. Farr Davies said that he was pleased to tell them that his company had come to an agreement with a very large power company in South Wales to supply the collieries with power during certain periods of the day and the colliery company, in turn, would assist them to carry their peak loads during other periods.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Col. R. E. Crompton, C.B., R.E., M.Inst.C.E., M.I.E.E., has entered into partnership with Dr. Alfred Ekström, M.I.E.E., who has specialised in the problems of applying electrical energy to agriculture in Sweden. The partners will act as consultants on similar matters in the United Kingdom and in the Colonies.

Captain F. T. Billingsley, A.I.R.O., is leaving the staff of the Ayrshire Electricity Board to take up an appointment under the Central Electricity Board in the Central England area. Captain Billingsley has had very wide experience of e.h.p. transmission and electricity supply, both in this country and abroad. Previous to joining the Ayrshire Electricity Board he held the appointment of assistant electrical engineer to the Gold Coast Government Railway, and from 1920 to 1924 he was assistant engineer to the Burma Electric Tramway and Lighting Company.

The Bradford Education Committee recommends the appointment of Mr. E. M. Price, of Manchester, as lecturer in electrical engineering at the Technical College.

The Bradford Corporation Electricity Committee has appointed Mr. William Dundas, resident engineer at the Barton power station, as deputy city electrical engineer at a salary of £900 a year, rising to £1,000.

Mr. T. H. DENNIS, M.I.E.E., managing engineer, Straits Trading Co., Ltd., Singapore, is on leave in England and expects to remain here until the end of the year. His London address is c/o Messrs. W. E. Moulsdale & Co., Ltd., Victoria Station House, Victoria Street, S.W.1. No circulars, &c., are required.

The Lord President of the Council has appointed the Rt. Hon. Lord Rayleigh, D.Sc., F.R.S., Sir Arthur Balfour, K.B.E., Sir William H. Bragg, K.B.E., D.Sc., F.R.S., and Sir James Walker, D.Sc., Ph.D., LL.D., F.R.S., to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

The following members of the Advisory Council have retired on completion of their terms of office:—Sir H. C. Harold Carpenter, F.R.S., Dr. G. C. Clayton, C.B.E., Sir Richard T. Glazebrook, K.C.B., F.R.S., and Sir James H. Jeans, D.Sc., LL.D., secretary of the Royal Society.

The marriage took place at Rugby, on September 3rd, of Mr. ALFRED FERDINAND FOWLER, formerly on the staff of the British Thomson-Houston Co., Ltd., and now with the West Midlands Joint Electricity Authority at Wolverhampton, and Miss L. E. HILL, only daughter of Mr. T. Hill, of Rugby. Mr. Fowler received a clock from his colleagues at Wolverhampton.

Mr. A. E. ROOTS, chief assistant engineer of the Worcester Electricity Department, has been appointed out of 64 applicants burgh electrical engineer and manager at Dumfries.

The *Telegraph and Telephone Age* reports that Mr. ALFRED E. POWELL was recently appointed vice-president of the Commercial Cable Co. in charge of plant and engineering. Mr. Powell was born in London in 1874 and received his engineering training at the Chelmsford works of Crompton & Co. and at University College, London, under Prof. (now Sir) J. A. Fleming and Prof. Hudson Beare. Later he was with a storage battery company and then became an assistant to Mr. S. G. Brown. He joined the Western Union Telegraph Co. in London in 1915, and in 1920 went to New York as general plant manager of ocean cables. He became chief plant engineer to the Commercial Cable Co. in 1924. Mr. Powell is a member of the Institution of Electrical Engineers.

Mr. R. J. CARTER, of the staff of the Kettering electricity works, who was married on September 4th, was presented by his colleagues with an oak clock and barometer.

Mr. J. H. WHITEHEAD, who has for the past six years been a transformer engineer with Ferranti, Ltd., of Hollinwood, has been appointed lecturer in electrical engineering at the Constantine Technical College at Middlesbrough.

After being connected with Chislet Colliery (Kent) as agent and manager for the past 7½ years, Mr. JOHN W. ROBINSON is shortly severing his association with the colliery. For the last two years he has been president of the London branch of the Association of Mining Electrical Engineers, and at present he is chairman of the Council of the Kent Coal Owners' Association, the Kent District Mining Board, and the Kent District Welfare Committee, and by these, and other bodies, his wide knowledge and experience of mining conditions in Kent will be greatly missed.

Mr. F. O. ILES is leaving England by the *Carnarvon Castle* on September 27th for South Africa and Rhodesia, in the interests of his company, Messrs. Ruston & Hornsby, Ltd.

The Salford Tramways and Motor-'Bus Committee has appointed Mr. C. E. BARTON, of the Bradford Corporation Tramways Department, to be rolling-stock engineer at a commencing salary of £550 per annum.

The marriage between Mr. H. J. HERRERA, electrical engineer and manager to the Risca Council, and Miss MOIRA MACLAREN, daughter of the late Mr. John MacLaren, M.R.C.V.S., was solemnised at Newport, Mon., on Saturday, September 7th.

The Department of Overseas Trade announces that Mr. C. J. KAVANAGH, the Commercial Secretary at Berlin, has resigned that position, with effect from the end of September, in order to take up a business appointment. The Department has placed on record its appreciation of the valuable services rendered by Mr. Kavanagh.

The re-opened Trade Commissioner post at Singapore has been filled by the appointment of Mr. R. BOULTER, C.M.G., at present Commercial Secretary in Tokio. Mr. Boulter expects to reach Singapore in November.

The appointment of Mr. H. H. LANCASTER, the Blackpool Corporation tramway traffic superintendent, to a similar position with the Leeds Corporation is the subject of a resolution by the Blackpool Electricity Committee placing on record its high appreciation of the services he has rendered to the Corporation in connection with the tramway undertaking, extending over a period of twenty years.

At the Tramways and Transport Committee of the Plymouth Corporation, the resignation of the engineer and manager on his appointment as general manager of the United Automobile Services Co., was submitted, and the committee placed on record its high appreciation of the valuable services rendered by Mr. STOKES as engineer and manager of the undertaking extending over a period of ten years, during which the undertaking has been re-organised and considerably extended.

Obituary.—Mr. GEORGE NEW.—The death has occurred at Sunderland of Alderman George New, chairman of Sunderland Corporation Tramways Committee for the last 18 years. Alderman New, who was 67 years of age, was a leading member of the Town Council and keenly interested in transport problems. As chairman of the Development Committee and then of the Parliamentary Bill Committee, he was largely responsible for the Corporation securing its Act of 1927 by which the borough area was nearly doubled and new transport powers were secured. Sunderland's tramcar service was suspended for one minute during Alderman New's funeral on Saturday, which over 100 tramway and 'bus employés attended.

Mr. C. COWLISHAW.—The death is announced of Mr. C. Cowlishaw, of Coventry, after a short illness. He had been employed by the Singer Co., Ltd., for close on 23 years as chief electrician.

Mr. P. W. LASHAM.—The death has taken place, after an operation, of Mr. P. W. Lasham, who had for many years been on the secretarial staff of the Reading Electric Supply Co. He was 37 years of age.

Will.—Sir SASSOON JACOB DAVID, Bt., chairman of the Bombay Electric Supply & Tramway Co., who died in September, 1926, left £4,242 net in England, and £241,125 in India, making a total of £245,367, exclusive of trust property valued at over 20 million rupees.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

R. Darbyshire (Wholesale), Ltd.—Private company. Registered September 5th. Capital, £2,000, in £1 shares. Objects: To carry on the business of electricians, electrical and mechanical engineers and contractors, &c. The directors are:—R. Darbyshire, "Beechwood," Newton Drive, Blackpool; W. Darbyshire, address not stated; J. Hollas, address not stated. Secretary: W. B. Haworth. Registered office: 2, St. John's Walk, Abingdon Street, Blackpool.

Vocosol, Ltd.—Public company. Registered September 4th. Capital, £30,000, in 2s. shares. Objects: To acquire, turn to account and trade with certain inventions relating to a system of translating mechanical vibrations into electrical waves, to carry on business in connection with gramophones or phonographs, musical instruments, records, receivers, batteries, frame and other aerials, accumulators, induction coils, variometers, amplifiers, condensers, telephones, loud speakers, &c., and to carry on the business of radio, electrical and kinematograph engineers, &c. Minimum cash subscription, 7 shares. Directors: C. W. Iveson, The Gables, First Avenue, Westcliff-on-Sea (director of Williams Lea & Co., Ltd.); Major W. H. Montgomery, The Glen, Colchester; R. G. Tugwood, 38, Mildmay Park, N.4, merchant. Secretary: R. Death. Solicitor: J. E. M. Crowther, 23, Abingdon Street, Westminster.

Rayzone, Ltd.—Private company. Registered September 2nd. Capital, £5,000 in £1 shares (3,000 ordinary and 2,000 8 per cent. preference). Objects: To acquire any invention relating to electric and other lamps of all kinds, to adopt an agreement with John Lister & Co. and J. R. Quain, and to carry on the business of manufacturers of and dealers in appliances and processes for medical, surgical, therapeutic, hygienic, chemical, scientific, or other purposes, electricians, &c. The subscribers (each with one share) are: R. H. Watkin, Marl-

pit Farm, Coulsdon, engineer; A. F. Doubell, 19, Langdale Road, Thornton Heath, clerk. The first directors are to be appointed by the subscribers. Secretary: R. H. Watkin.

A. H. Whitehead & Co., Ltd.—Private company. Registered August 31st. Capital, £300 in £1 shares. Objects: To carry on the business of electrical, mechanical, radio, and sanitary engineers, &c. The directors are: A. H. Whitehead and Mary E. Whitehead, 92, Upper Brook Street, Chorlton-on-Medlock, Manchester. Registered office: 92, Upper Brook Street, Chorlton-on-Medlock, Manchester.

Gloucester Ignition Service, Ltd.—Private company. Registered August 29th. Capital, £1,200 in £1 shares (600 6 per cent. cumulative preference and 600 ordinary). Objects: To acquire the business of electricians, now carried on at 145, Barton Street, Gloucester. The permanent directors are: C. T. Menning, electrical engineer, and Mrs. M. C. Menning, 145, Barton Street, Gloucester. Registered office: 23, London Road, Gloucester.

Official Returns of Electrical Companies.

British Electric Transformer Co., Ltd.—Capital, £1,000,000 in £1 shares (300,000 preference and 700,000 ordinary). Return dated June 4th, 1929. 300,000 preference and 329,821 ordinary shares issued and fully paid up. Mortgages and charges: £20,000.

N.E.S. (Bradford), Ltd.—Capital, £1,500 in £1 shares. Return dated March 29th, 1929. 1,100 shares taken up. £900 paid and £200 considered as paid. Mortgages and charges, nil.

Archibald J. Wright, Ltd.—Capital, £3,000 in £1 shares (2,980 ordinary and 20 deferred). Return dated January 14th, 1929. 2,007 ordinary and 6 deferred shares taken up. £1 paid on 7 shares. £2,006 considered as paid on 2,006 shares. Mortgages and charges: £1,000.

Siemens & General Electric Railway Signal Co., Ltd.—Capital, £20,000 in £1 shares (10,000 "A" ordinary and 10,000 "B" ordinary). Return dated May 29th, 1929. 3,500 "A" ordinary and 3,500 "B" ordinary shares issued and fully paid up. Mortgages and charges, nil.

Bordesley Electrical Accessories Co., Ltd.—Capital, £5,000 in £1 shares. Return dated March 13th, 1928 (filed March 28th, 1929). 4,812 shares taken up. £2,500 paid. £2,312 considered as paid. Mortgages and charges: Bank holds deeds of property up to £1,000, as security against overdraft. Overdraft at March 13th, 1928, £1,642 13s. 1d.

Everett (Southampton), Ltd.—Capital, £50 in 1s. shares. Return dated April 5th, 1929. 1,000 shares taken up. £50 paid. Mortgages and charges, nil.

J, P. Hall & Co., Ltd.—Capital, £35,000 in £1 shares. Return dated April 11th, 1929. All shares taken up. £35,000 paid. Mortgages and charges, nil.

Sheringham & District Electricity Supply Co,, Ltd.—Capital, £2,000 in £1 shares. Return dated May 27th, 1929. 400 shares taken up. £400 paid. Mortgages and charges, nil.

New Radnor Electric, Ltd.—Capital, £650, in £1 shares. Return dated June 4th, 1929. 632 shares taken up. £600 paid. £32 considered as paid. Mortgages and charges, nil.

Wandsworth Electrical Manufacturing Co,, Ltd.—Capital £25,000 in £1 shares. Return dated April 24th, 1929. 17,230 shares taken up. £14,365 paid. £2,865 considered as paid. Mortgages and charges, nil.

Madras Electric Tramways (1904), Ltd.—Capital, £200,000, in 125,000 preference and 75,000 ordinary shares of £1 each. Return dated May 22nd, 1929. 100,000 preference and 75,000 ordinary shares taken up. £85,240 paid on 67,500 preference and 17,740 ordinary shares. £89,760 considered as paid on 32,500 preference and 57,260 ordinary shares. Mortgages and charges: £130,000.

British Thomson-Houston Co,, Ltd.—Capital, £4,000,000, in 2,000,000 7 per cent. cumulative preference and 2,000,000 ordinary shares of £1 each. Return dated May 22nd, 1929. 1,500,000 preference and 2,000,000 ordinary shares taken up. £3,425,310 paid. £74,690 considered as paid. Mortgages and charges: £1,518,115.

Derby Cables, Ltd.—Mortgage on New Close, Little Chester, with cable factory, &c., thereon and the company's undertaking and property, present and future, including uncalled capital, dated August 22nd, 1929, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

British Phototone, Ltd.—Particulars filed of £6,000 debentures authorised August 1st, 1929, charged on the company's undertaking and assets, including uncalled capital, the amount of the present issue being £500.

Lancashire Dynamo and Motor Co., Ltd.—Capital £320,000 in 260,000 ordinary and 60,000 preference shares of £1 each. Return dated April 9th, 1929. All shares taken up. £320,000 paid. Mortgages and charges: £75,000.

Sherborne Electric Supply Co., Ltd.—Capital £15,000 in £1 shares. Return dated March 28th, 1929. All shares taken up. £15,000 paid. Mortgages and charges, nil.

Watford Electric & Manufacturing Co., Ltd.—Debenture dated August 22nd, 1929, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. M. Anstee, Cassiobridge, Watford.

Dionoid Battery Co., Ltd.—Particulars filed of £1,000 debentures authorised August 2nd, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

City Notes.

Electramonic Radio, Ltd.

The *Financial News* reported last week that an extraordinary meeting of shareholders was called for Wednesday last by Mr. W. H. Sayers, the vendor to, and managing director of, the company. In the course of the notice convening the meeting Mr. Sayers stated that the Christmas trade of the company had been lost by reason of improvements in portable wireless sets, and by January last there was a shortage of cash to meet liabilities and carry on manufacture. Large numbers of loud-speakers had been bought from Celestion, Ltd., which was pressing for the payment of a final account of £2,500, which he (Mr. Sayers) had personally guaranteed, as well as £2,400 due to other creditors. In February last it was decided to arrange a scheme of joint working with Celestion, Ltd. Under this there were changes in the board, and Celestion, Ltd., was to purchase the Electramonic factory, machines and plant for £22,500, part of which sum had already been advanced to the company. The Electramonic Co. was to become a selling company, and Celestion, Ltd., would advance a further £20,000 on the security of stocks in hand. Mr. Sayers was to transfer 10,000 fully-paid preferred and 60,000 fully-paid deferred shares (his personal property) to Celestion, Ltd. These arrangements had been carried out except that Celestion, Ltd., had not yet advanced any part of the £20,000, as it did not desire to call up further capital until next month. Mr. Sayers further stated that his co-directors had disregarded a requisition from the holders of more than 10 per cent. of the issued capital for an extraordinary meeting, and had instead decided to call a meeting in order to pass a resolution for the voluntary winding up of the company.

A statement circulated by Sir Philip Dawson, the chairman, indicates that soon after the company's formation there were differences of opinion between Mr. Sayers and the other directors. In February the situation was such that unless the company could dispose of some of its assets and pay off some of the creditors, winding up would have been unavoidable. Accordingly an arrangement with the Celestion Co. was entered into. Sir Philip states that the board found that Mr. Sayers had entered into commitments without its knowledge or approval, with the consequence that the anticipated excess of assets over liabilities was reduced from £40,000 to £16,000, none of which was in cash. Consequently the plan of the board to use the proceeds of the sale of assets to Celestion, Ltd., for carrying on the sales organisation was frustrated. Sir Philip considers that the business of the company can yet be successfully developed "severed from the encumbrances with which it has been so heavily handicapped."

A further statement by Mr. Sayers was published this week, in which he claimed that the Court had granted him an interim injunction restraining the board from carrying out his duties as director. The chairman had stated that the Court had refused to grant such an injunction. A meeting of shareholders was convened by the board for yesterday (Thursday).

Burndept Wireless (1928), Ltd.

The directors' report for the ten months ended June 30th last (the new company's first trading period) shows a net profit of £15,979 (subject to income tax). It is proposed to allocate this as follows:—Bonus to staff, £375; premises reserve, £1,200; writing off goodwill, and one-third of preliminary expenses and underwriting commission, £5.325; dividend of 5 per cent. actual, less tax, £6,200; leaving £2,878 to be carried forward. The directors consider the results to be entirely satisfactory, having regard to the particular circumstances of the period. Although the company acquired the business with effect from September 1st, 1928, the receiver and manager remained in possession until November 14th; consequently the essential early preparation for the ensuing radio season was somewhat hampered. Despite this the output was much larger than in any corresponding period in the history of the Burndept business. The company's reputation for high-quality products has been maintained; the directors look forward to increased business during the current year, and the outlook is distinctly encouraging. The meeting is to be held to-day (Friday).

Edison Swan Electric Co., Ltd.

The accounts for the eighteen months ended December 31st, 1928, show a profit of £76,991, after making provision for debenture service, &c., to which is added £31,903 brought forward, making £108,894. After allowing for the preference and ordinary dividends for the year to June 30th, 1928, there remains £82,250. The remainder of the preference dividend for the period is paid, and the directors recommend a dividend at the rate of 10 per cent. per annum on the ordinary shares for the half-year to June 30th last. This, with the 10 per cent. dividend paid in January, makes a total distribution of 15 per cent. for the eighteen months. (For 1926-27 the dividend was 10 per cent.) £50,000 is placed to reserve and £18,929 is carried forward. Meeting: September 16th.

Power Corporation of Canada.

The operating revenue for the year ended June 30th last amounted to $1,947,590, as compared with $849,871 in 1927-28, while the gross earnings rose to $3,312,104. The net earnings were $2,846,418, against $1,802,557, and the amount available for common stock dividend was $1,765,829, equivalent to $4.46 per share. Dividends actually paid absorbed $394,843, and after writing off $550,000 from discount on securities, the surplus is $2,502,919. The assets increased by over $18,000,000 to $46,963,045. The policy of the company, according to Mr. A. J. Nesbitt, the president, is to pay cash dividends out of the revenue only; any stock dividends will be paid out of the profits realised from the sale of investiments, thus conserving the company's cash resources.

Crompton Parkinson, Ltd.

The directors' report for the year ended June 30th last records a net profit, after meeting depreciation, debenture interest, &c., of £85,272. To this is added £44,551 brought forward, making £127,123. The preference dividends are paid and £13,500 is transferred to general reserve. It is proposed to pay a final dividend of 18¾ per cent. actual on the ordinary shares, making 30 per cent. for the year, leaving a balance of £50,359 to be carried forward. During the year Mr. Thomas Britten retired from the board and Col. R. E. Crompton has been appointed a director. The meeting is to be held on September 19th.

British Columbia Telephone Co.

The report for the year ended March 31st last records a total operating revenue of $4,768,312, as compared with $4,317,212 for 1927-28. After providing for operating expenses, maintenance, depreciation and employés' benefit fund there was a balance of $1,062,784, against $933,881. From this debenture interest, &c., was deducted and the allocations include $360,000 for ordinary dividend ($315,000), and $330,000 ($307,500) for preference and preferred dividend. A balance of $98,995 (against $88,956) is transferred to surplus.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

Atlas Light and Power Co., Ltd.—£749,533 5 per cent. debenture stock.

Dealings in the following have been allowed by the Committee under Rule 159:—

Brush Electrical Engineering Co., Ltd.—£11,029 2s. 3d. ordinary stock.

Pernambuco Tramways and Power Co.

The *Financial News* states that the report for the year ended December 31st last shows gross receipts of £499,146 and net receipts plus transfer fees, &c., of £212,322. After providing for renewals debenture and note interest, &c., there remains a net profit of £72,945, which added to the balance of £10,786 brought forward makes £83,731.

Cammell, Laird & Co., Ltd.

The directors of the company stated last week that they could not recommend the payment of interim dividends on the cumulative preference or ordinary shares. The last distribution on the 5 per cent. cumulative preference was in 1925, while the ordinary shares have received nothing since 1923.

English Electric Co., Ltd.

The directors stated last week that they were again unable to recommend the payment of a dividend upon the 6 per cent. cumulative preference shares. The dividend on these shares is in arrear from July 1st, 1926, and the last ordinary dividend paid was 5 per cent. in respect of 1924.

Ward & Goldstone, Ltd.

An interim dividend at the rate of 7½ per cent. per annum has been declared on the ordinary shares.

British Columbia Power Co.

A dividend of $0.50 per share has been declared on the Class "A" shares for the quarter ending September 30th.

William Beardmore & Co., Ltd.

On September 4th the holders of the company's first mortgage debentures approved a scheme of reorganisation which, *inter alia*, modifies their rights.

Stocks and Shares.

TUESDAY EVENING.

So long as there remains in the air the apprehension that the Bank Rate may change in the upward direction, so long will investment securities continue to reflect the feeling of uncertainty that continues to prevail. It sounds surprising, though it is not altogether unique, to hear many people in the City saying that they will be glad, rather than the reverse, to hear of a rise in the Bank rate, insomuch as this will put an end to the suspense that has overhung the monetary situation for some six weeks past. As a matter of fact, the possibility of a 6 per cent., or even a 6½ per cent., minimum, is discounted to some extent, and a good many gilt-edged securities show falls of several points in their present prices as compared with those of seven months ago, when an alteration last occurred in the Bank Rate.

Electricity Supply.

In the electricity supply market, County of London Electric ordinary shares have been strong at 58s., on the understanding that the new issue, whatever shape it may assume, is on the point of being made. During the early days of this week, a few profit-takers appeared; on balance the alteration in the nominal quotation amounts to nothing. Metropolitan Electrics have been a good market, with a further rise to 45s. 9d. According to rumour, the reason is a continued demand from American sources, and to the same region of support is attributed the buying of North Metropolitans, the price of which has risen 1s. 6d. to 53s. 6d. Egham and Staines are 2s. 6d. up, at 39s. 6d. Scottish Power strengthened to 32s., and the new shares to 2s. premium. No particular change has occurred in the shares of the provincial group, most of which hold the strength they acquired during the latter half of August. Bournemouth and Poole at 67s. 6d. are 1/16 lower.

Cables and Wireless.

The main feature in the market for Telegraphs and Telephones is a recovery in the "B" ordinary stock of Cables and Wireless, Limited. The price, after its drop of 6½ points last week, has recovered 2½ to 68, and stock has been changing hands up to 71 during the past few business days.

The price of Cables and Wireless preference is unchanged at 95, and the ordinary keeps steady at 82½. Some people are buying the three stocks, to hold as an investment, looking towards the possibilities of the 7½ per cent. "A" ordinary stock receiving 5 per cent. in respect of the current year, while the preference pays, of course, 5½ per cent. At the present prices, the purchase of £100 of each stock would cost about £247, the estimated dividend on which, taking 5 per cent. on the ordinary stock, is 10½ per cent. for the first year, with the strong probability of an increased distribution in the course of a year or two.

The Globe Telegraph and Trust Co. has declared its usual dividend, for the quarter, of 5s. tax-free, and the price of the shares is unchanged at 25½.

Marconis.

One reason for the recent depression in the price of the Cables and Wireless "B" stock is that some of the holders of the Eastern Cable trio elected to sell the "B" and to put the money into the company's 5½ per cent. preference stock as being a sounder security, though not carrying the speculative possibilities that attach to the "B" ordinary stock in the future. Marconi Marine shares have rallied to £3 on cessation of the late pressure to sell.

The Marconi Irish Shareholders' Association has decided to wind up, but a new association is to be formed under the title of Cables and Wireless Shareholders' Association. The latter has communicated with Cables and Wireless, Limited, suggesting the quotation of shares in the Stock Exchange on the basis of £1 units, instead of £100 stock. The Stock Exchange Committee has already under consideration this very desirable development, but its attention is at present concerned with a modification of the proposed new law relating to distinctive share numbers, and, until this is settled, the matter may remain in suspense.

Burndept Wireless (1928) has announced a dividend at the rate of 6 per cent. per annum, and a start has been made towards tidying-up the balance sheet by the reduction of preliminary expenses, underwriting commission, goodwill, &c. The price of the shares is 4s. 3d.

Dollar Stocks.

The feature amongst dollar stocks this week is a rise of 19 points in Mexican Light and Power common, which has raised the shares to 123½. No further explanation of the jump in the price can be advanced, other than insistent demand from Montreal and New York, where certain trusts connected with utility undertakings are accumulating stock in any companies connected with lighting, power and traction. Other Mexicans are, however, somewhat quiet, and Mexico Tramways shares at 58 are a point or two lower than they have been. Montreal

Light, Heat and Power rose 5¼ to 160. Canadian General Electrics at 410 have added 10 to their previous very substantial gain; Power Corporation of Canada shares at 130 are 7½ points down, while Shawinigan fell 3 to 109. Hydro-Electrics have been a very animated market, and, after touching 82, reacted to 80. International Holdings are ¾ lower at 12¾, Brazilian Tractions have slipped back to 70, a fall of 3 points on the week. The preferred lost 5 of their 25 points gain, and are now 230. Sofinas are dull at 4. Of the telephone shares, Internationals at 144½ are 5½ down, American Telephone and Telegraph remain at 300. Radio Corporation shares have been moving in violent and erratic fashion; the price jumped to 112 before easing off to 110¼.

Manufacturing and Equipment Shares.

Lively dealings are taking place in the shares of the Associated Electrical Industries, and in General Electric Co., Ltd., ordinary. The prices of both have been moving rapidly, with American orders as the main cause for the fluctuations. Associated rose to 50s., showing a gain of 2s. 6d., but reverted to 46s. 3d. G.E.C.'s have risen to 3 1/16, as compared with 2⅞ a week ago. It is not easy to account on this side for the avid demand shown by American purchasers, although when compared with the rises which have taken place in some of the United States utility stocks and shares, the strength of British issues in which Americans are interested is, in homely phrase, nothing to write home about. One of the constituent companies of the Associated Electrical Industries—the Edison Swan Electric Company—has declared 10 per cent. dividend on the ordinary shares. Edison Swan first preference are quoted 24s. 6d., at which they pay a little over 7 per cent. on the money, and the company's 5 per cent. debenture stock, standing at 84½, yields practically 6 per cent. when allowance is made for accrued interest. Enfield Cable shares stand out with a rise of 3s. 9d. to 4¾, and there is a shrewd idea that something in the nature of a bonus issue may be expected within the fairly near future. The company is doing, moreover, remarkably well, and its management is known to be excellent. English Electric preference advanced sharply to 9s. 6d., following upon the improvement to 8s. 9d. which occurred last week in the ordinary shares. Urgent advices to buy Sphinx Electric ordinary and preference shares should be regarded with caution by investors who put safety first.

Babcock & Wilcox moved back a little to 66s. 3d. Iron and steel shares as a whole show a fair amount of firmness, Vickers remaining at a shade below 10s. British Aluminium ordinary rose 1s. 9d. to 51s. 3d., and improvements that had already occurred this month amongst the shares of the manufacturing and equipment group are generally maintained. An exception is Siemens ordinary, the price of which eased off to 28s. 9d. The company's 10 per cent. preference keep very firm at 32s. Callender's 6½ per cent. preference are 23s. 6d., and the 7½ per cent. "B" preference 27s. Ericsson Telephone 7 per cent. preference seldom move from 20s. Hall Telephone Accessories are 15s. 6d. and Telephone Manufacturing 4s.

Home Railways and Trams.

The enthusiasm for Home Railway stocks has again been running high. Most of the steam issues are better on the week, and in the Underground group, Metropolitan consolidated ordinary at 61 shows a rise of 2½ points. Districts have scarcely moved for a month, and are still 72½, while Underground incomes remain at 111, and the £1 shares at 23s. 6d. No changes have occurred in Central London stocks, the 4 per cent. ordinary assented remaining at 71.

British Electric Traction deferred, after its dip to 1,600, holds its recovery to 1,650. A fall of 2 points lowered London United Tramways debenture to 55.

Electric Bond and Share.

A correspondent, who writes on notepaper with a Mexican address, asks whether the ELECTRICAL REVIEW is cognisant of purchases made by the Electric Bond and Share Company of New York. This latter is, of course, one of the best-known undertakings in its own particular business, and it has been particularly prominent in the purchases of stocks and shares in utility concerns. Our correspondent points out that the company has made purchases in no fewer than 10 electrical power undertakings in Mexico this year, and he adds that in private advices he hears of other acquisitions which have been made, and recently, by the Electric Bond and Share Company. These developments go some way, no doubt, to explain the demand that there has been for shares in the Mexican utility companies, another illustration of which may be cited in the common shares of the Puebla Light and Power Company. These we were mentioning three weeks ago as offering opportunities, frankly, to the speculator, the price of the shares at that time being about 17. As it happened, a few hundred shares came in, and the price incontinently fell to 15. On the floating supply being absorbed, the price has recovered to 20, though this is not likely to satisfy purchasers who were on the look-out for shares in the neighbourhood of 17, and who announced their intention of keeping whatever they were able to obtain until the price had doubled.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend. 1927.	1928.	Price Sept. 10 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	67/6	—1/16	4 9 0
Brompton Ordinary	1	8½	8½	26/-	—6d.	5 7 8
Charing Cross Ordinary	1	8¼	8¼	26/-	—	5 7 8
do. do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8¾	8⅞	25/6	—	5 9 10
City of London	1	10	10	33/3	—	4 4 6
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	26/3	—	... ...
County of London	1	7	10	57/6	—	3 9 9
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	53/3	—	4 2 8
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	28/6	—	5 5 2
London Electric	1	8½	9	27/6	—	5 1 10
Metropolitan	1	9	9	45/9	+9d.	3 18 6
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	24/6	—	3 15 4
Mid. Elec. Power	1	15	8	36/3	—½	4 8 2
Newcastle-on-Tyne Ordinary	1	6	6	27/-	—	4 9 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	26/6	—	5 5 8
Scottish Power	1	8	8	32/-	+6d.	5 0 0
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	—	33/3	—	... ...
Westminster Ordinary	1	8½	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/-	—	6 0 0
Yorkshire Elec.	1	8	8	26/6	—	4 7 8

HOME RAILS.

Central London Ord. Assented	Stock	4	4	71xd	—	5 12 8
Metropolitan	"	8	8½	61	+2½	5 14 9
do. District	"	4	5	72½	—	6 18 0
Underground Electric	£1	5	7	23/6	—	5 19 2
do. do. Income	Bonds	6	6	111	—	5 8 1

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	"	1½	1½	24½	—	6 4 6
Automatic Telephone	1	10	12½	38/3	—	6 11 0
Cables & Wireless 5% Pref.	Stock	—	—	95	—	5 15 9
do. A 7½ Ord.	"	—	—	82½	—	... ...
do. B Ord.	"	—	—	98	+5½	... ...
Globe Tel. and T. Ord.	10	10	10	25½	—	*3 18 6
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	20	17½	31	—	5 13 8
Indo-European	25	10	10	47½	—	*5 5 8
Marconi-Marine	1	12½	15	3	+¼	5 0 0
Oriental Telephone Ord	1	12	12	3	—	... ...

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	8 7/16	—	8 0 0
do. do. 2nd Pref.	5	6	6	8⅜	—1/16	8 17 10
do. do. 5% Deb.	Stock	5	5	74½	—	6 14 8
British Electric Traction Def. Ord.	"	5	5	1650	—	... ...
do. do. Pref. Ord.	"	8	8	128	—	6 5 0
Brazil Traction	100	7	8	70	—3	2 17 2
Brit. Columbia Elec. Ry. Pcc.	Stock	5	5	90½	—1	5 10 6
London & Sub. Trac. 5% Pref.	1	Nil	Nil	10/-	—	... ...
London United Tram Deb.	Stock	4	4	55	—2	7 5 6
Mexico Trams, 5% Bonds	—	5	5	75½	—2	6 12 5
Mexican Light Common	100	Nil	Nil	12½	+19	... ...
do. 7% Pref.	100	7	7	81½	—	8 11 10
do. 1st Bonds	—	5	5	78	—	6 12 5
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

Assoc. Elec. Ord.	1	6	—	2 1/16	—1/16	2 12 0
Babcock & Wilcox	1	13	15	66/3	—9d.	*4 10 7
British Aluminium Ord.	1	10	10	51/3	+1/9	*3 18 0
British Elec. Transformer Pref.	1	7	7	18/9	—	9 6 8
British Insulated Ord.	1	15	15	8¾	—	4 0 6
Brush Ord.	Stock	10	10	131	—	7 12 8
Callenders	1	15	15	8¾	—	4 0 0
do. 6½% Pref.	1	6½	6½	1¾	—	5 4 0
Crompton Parkinson Ord.	5/-		—	22/6	—	... ...
do. 6% Pref.	1	8	—	25/-	—	6 2 6
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 8
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	8½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4¾	+3/16	4 4 2
English Electric	1	Nil	Nil	8/9	—	... ...
do. do. Pref.	1	8	Nil	9/6	+1/16	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	3 1/16	+1/16	3 5 5
Henley	1	25	30	6¼	—	4 16 0
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	12/6	—	... ...
Johnson & Phillips	1	10	—	2	—	5 0 0
Siemens Ord.	1	7½	7½	28/9	—1/16	5 4 4
Telegraph Construction	12	10	10	33	—	5 4 2

* Dividends paid free of Income Tax.

A Large Electric Sign.

The sign which was recently installed at "Selfridges," in connection with the birthday celebrations of that firm, was claimed to be the largest in the world.

THE accompanying illustrations depict what was claimed to be the largest electric sign in the world. It was erected by the IMPERIAL LIGHTING CO., LTD., on the "Selfridge" building, London, and used in connection with the recent birthday celebrations of that firm.

The sign extended the whole length of the building, a distance of 550 ft., and contained no less than 2,000 letters and 30,000 lamps. It was erected in four weeks, Imperial Lighting Co. working twenty-four hours a day. The entire sign was divided up into bays between the pillars fronting the building, each bay being suspended on battens and cables in such a way that dismantling would occupy the least possible time.

Fig. 1.—The Complete "Selfridge" Sign.

The two thousand letters were of flat section, some of them being cut from three-ply wood, and some from lead-coated steel. They were all fitted with the Imperial Lighting Co.'s No. 900 "Fairyland" S.E.S. lampholders, and 14-volt, 7-watt lamps. Twenty-two miles of cable were used in the supply system.

The central feature was a coloured cut-out of an equestrian figure typifying energy, and ranged on either side, 40 ft. high, are the banks of letters spelling the salient points of Messrs. Selfridge's policy. There were twenty of these "mottoes"—one for every year of the firm's establishment, from 1909 to 1928, and two others at the sides which are not shown in the illustration, fig. 1.

Although this vast erection is referred to as a "sign," it may be described as a collection of a large number of signs, and some idea of its size may be gathered from the fact that each bay was quite as large as the average Piccadilly Circus display. The dates and lettering were composed of 4-ft. letters, wired with the Imperial Lighting Co.'s patent

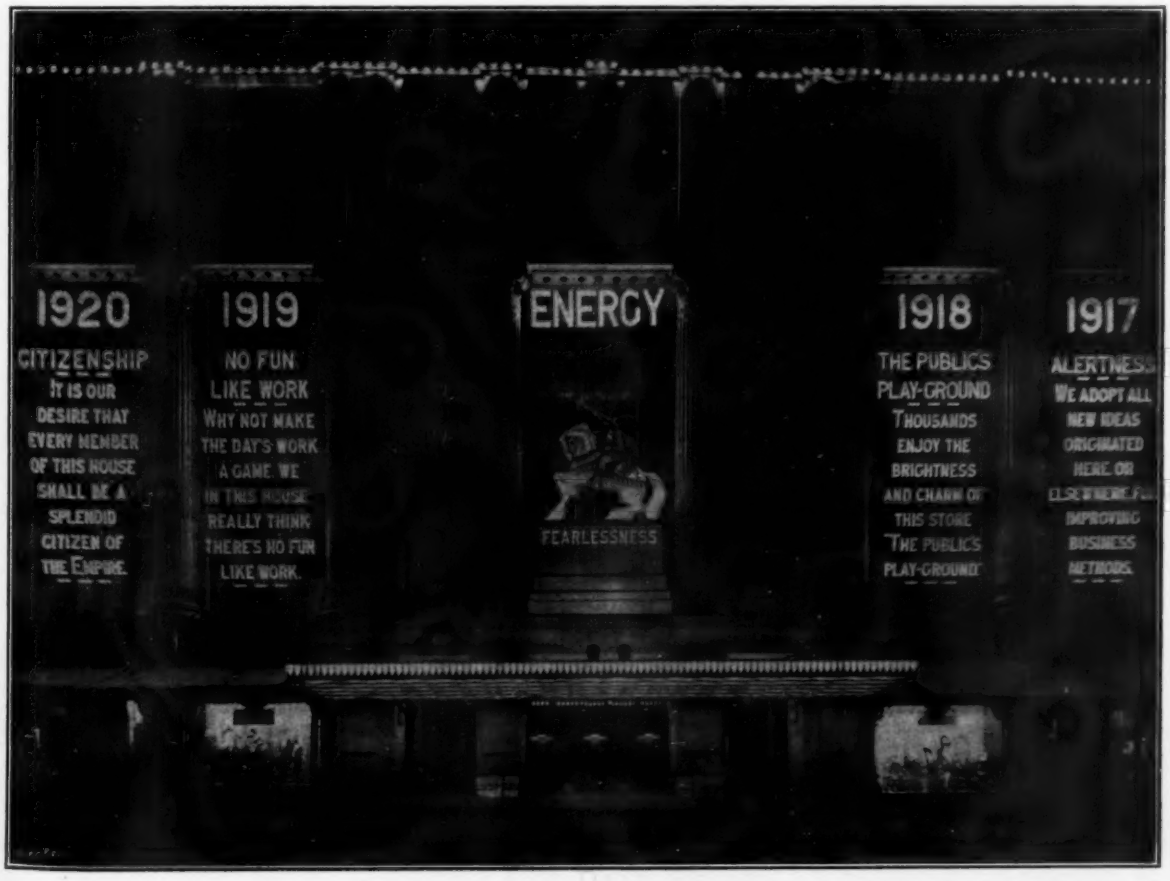

1920
CITIZENSHIP
IT IS OUR DESIRE THAT EVERY MEMBER OF THIS HOUSE SHALL BE A SPLENDID CITIZEN OF THE EMPIRE.
1919
NO FUN LIKE WORK
WHY NOT MAKE THE DAY'S WORK A GAME. WE IN THIS HOUSE REALLY THINK THERE'S NO FUN LIKE WORK.
ENERGY
FEARLESSNESS
1918
THE PUBLICS PLAY-GROUND
THOUSANDS ENJOY THE BRIGHTNESS AND CHARM OF THIS STORE
"THE PUBLICS PLAY-GROUND"
1917
ALERTNESS
WE ADOPT ALL NEW IDEAS ORIGINATED HERE OR ELSEWHERE FOR IMPROVING BUSINESS METHODS.

Fig. 2.—Centre Section of the Sign.

b.c. holders in ordinary parallel with 240-V, 20-W lamps. The remainder of the letters, 2,000 in all, were in two sizes, 24 in. and 18 in., and all these were wired in parallel-series, so that if one lamp went out all the remainder kept alight. The parapet was outlined with "Fairyland" strip, water-tight pattern, with 240-V, 30-W sign-type lamps, this feature being a permanency. The size of the equestrian figure was 12 ft.. high by 12 ft. wide, mounted on a base 12 ft. high; this was floodlighted by two "Imperial" floodlights.

A Bridge Ohmmeter.

A combined ohmmeter and Wheatstone bridge has been introduced by the Record Electrical Co., Ltd.

THE object of the "Bridge Ohmmeter," fig. 1, which has recently been introduced by the Record Electrical Co., Ltd., is to provide means of extending the range of an ohmmeter to enable it to measure low resistances, such as are met with in ordinary general industrial work. An ohmmeter usually gives its first indication at 10,000 ohms, and will measure any higher value up to 100 megohms and infinity. The "Record Bridge Ohmmeter" will measure resistances from .01 ohm up to 999,900 ohms on the bridge, and from 10,000 ohms to 100 megohms on the ohmmeter scale; it will also indicate a "short-circuit" or "open-circuit."

The instrument consists of four essential units: a generator for producing the necessary current at high pressure, a direct-reading ohmmeter convertible into a galvanometer for bridge tests, a decade resistance box with a ratio switch in one arm of the Wheatstone bridge, and a multiple-contact switch for changing connections from an ohmmeter to a Wheatstone

Fig. 1.—The "Bridge Ohmmeter."

bridge, all arranged in a portable carrying case complete with handle and shoulder strap. The containing case is made of teak, which has natural resilience, rendering it eminently suitable for portable apparatus. The dial and glass are protected by means of a strong metal cover. The carrying strap combines the two-fold purpose of a handle and shoulder strap, it being uncoiled for the latter purpose.

The indicating unit consists of two coils mounted on the same spindle, placed at an angle to one another, both rotating in the field of a permanent magnet. One coil carries the leakage current; the other exerts a controlling torque equivalent to the spring of a voltmeter, but with the important difference that, whereas a spring exerts a constant torque, a coil control varies with the pressure and automatically *compensates* for any variation in the testing voltage. Temperature errors due to the coils, any drop in magnet strength, and errors due to stray magnetic fields, all cancel out, due to the system of coil control.

The generator is wound for two voltages—500 volts for insulation testing and 250 volts for ohmmeter testing. The voltage is automatically changed by the switch used for converting the instrument from an ohmmeter to a Wheatstone bridge. The generator is fitted with a constant-pressure clutch which evens out voltage fluctuation and ensures steady and accurate readings on circuits having inductance or capacity. The "Record" improved handle is of novel design, and an entire departure from the folding-knee joint common to other makes. The handle consists of a lever in the form of a round rod with a handle firmly attached thereto; this shaft fits in a closely fitting sleeve and a right-angle turn folds the projecting handle flat against the case. The current given to the circuit by the generator depends upon the resistance under test. At infinity, of course, no current flows, but the potential at the terminals is highest, *viz.*, 500 volts, at a handle speed of 160 r.p.m. In making measurements on circuits in which capacity and inductance are present, care must be taken to speed the handle until the clutch slips.

The internal resistances are carefully and accurately wound and adjusted, the instrument is protected from shocks by substantial rubber feet, and the pointer comes instantly to rest at the correct indication, and is not affected by varying the speed of the generator, except as explained in a previous paragraph. The variable decade resistance box consists of four dials—units, tens, hundreds, and thousands—indicating from 1 ohm to 9,999 ohms in 1-ohm stages. By means of the ratio coils these figures can be multiplied or divided by ten or one hundred, thus extending the range from .01 ohm to 999,900 ohms.

To test insulation resistance connect the conductor to the terminal marked "line" and the casing to the terminal marked "earth." Turn the control switch to ohmmeter. All the connections are then made for "ohmmeter." Turn the generator handle steadily at about 160 r.p.m. The pointer will immediately deflect across the scale and come to rest at a scale mark corresponding to the value of the insulation.

To measure low resistance—say a coil of wire—connect the ends to the same pair of terminals as for ohmmeter tests, turn the control switch to bridge, which changes the internal connections to those of a Wheatstone bridge; the current coil of the ohmmeter becomes the galvanometer coil and its deflection is controlled by the pressure coil, the function of which is equivalent to the control exerted by the spring or torsion strip of an ordinary galvanometer. Turn the generator handle very slowly at first and increase or decrease the resistance until the pointer approaches balance on the infinity line; the generator speed should then be increased and final balance obtained. If the figures appearing in the windows of the resistance box are 771 and the ratio switch set to "divide by 10," the value of the resistance under test is 77.1 ohms.

A New E.D.A. Campaign.

The Importance of Adequate Wiring in the Home.

THE British Electrical Development Association has planned a long-period campaign for the extension of the use of electricity in the home. As our readers are aware, the Electrical Association for Women, at the suggestion of E.D.A., has carried out an "Outlet" Campaign which has met with considerable success. It is now the intention of E.D.A. to continue this Campaign with added force in the directions of personnel and finance. In a booklet which has been sent to members of the Association, the objects of the Campaign are stated to be as follows:—To encourage the demand for, and the provision of, adequate wiring in the home; to combat the idea that the installation of electric wiring is expensive; to show that the cost of using electricity for purposes other than lighting is small, compared with many other household expenses; and to encourage complete domestic electrification. In a foreword to the publication (E.D.A. 799/2), Dr. Ferranti, President of E.D.A., says that the object of the Campaign is to remove the restrictions imposed by the lack of adequate wiring points by setting up a common-sense standard wiring installation which will ensure that electricity may be freely used for all purposes, and that the electrical installation will be accorded its proper place in the equipment of a house. He appeals for the wholehearted support of everyone in the electrical industry. Such a standard installation as that referred to by Dr. Ferranti is available in the Women's National Specification, which the E.A.W. has published. The advancement of a similar specification will be an essential part of the Campaign. It will be designed for the instruction of the public, including architects and builders. The Campaign will also encourage a larger use of standard material, improve the standard of wiring, and increase the number of points wired in each house. It is pointed out that the Campaign is planned on somewhat similar lines to the "Red Seal" campaign carried out in the United States and Canada, which has met with remarkable success.

The appeal to the public will be designed to show the necessity for making provision for electric lighting in every home; the advantages of using electricity for purposes other than lighting; the necessity of providing adequate wiring; and the increased value of a house after it has been adequately wired. The builder and housing authority will be shown that the public requires its houses to be adequately and safely wired; that the Campaign will increase the demand for such houses; and that every effort will be made to circulate information concerning houses which are adequately wired for complete electric service.

The landlord will be shown that it is to his advantage to wire his property as there is a demand for wired houses; the extra cost is easily covered by the rent. Efforts will be made to convince architects of the value of the electrified home and

to encourage them to design houses on certain lines. The appeal to the public will be made by means of lectures and public meetings arranged by the Area Committees and Circles; by advertisements in the Press inviting application for the special booklet which is being prepared; by exhibition houses, window displays, kinema films, local advertising, &c.; and by the insertion of articles in the Press.

The first part of the Campaign will cover the period October 1st, 1929, to June 30th, 1930. The first draft of the Electric Home Wiring Specification has been submitted to thirteen electrical associations and the E.D.A. Provincial Area Sub-Committees for their consideration, and it is hoped to secure the approval and adoption of the specification at the meeting of the E.D.A Council in November and arrange for its immediate circulation.

The organisation and operation of the Campaign will be explained in detail and discussed during September at Area Conferences in the following centres:—London, Edinburgh, Glasgow, Manchester, Newcastle, Leeds, Birmingham, Cardiff and Bristol. All E.D.A. Circles have been asked to discuss the Campaign at their October meetings, and to organise joint conferences with the local branches of the E.A.W. during October and November.

Stress is laid upon the value of demonstration houses, and Circles are asked to make every effort to secure the co-operation of local builders and architects in this direction. The Association will provide notes for two special lectures, one for the general public and the other for architects, builders, landlords and estate agents, and Circles are asked to obtain voluntary lecturers and organise meetings. Copies of the Electric Home booklet and the Home Wiring Specification will be supplied gratis for distribution to members of sales staffs who are asked to make themselves thoroughly conversant with the E.D.A. recommendations. From time to time illustrations of special window displays will be issued, with instructions for their arrangement. The monthly programmes will contain particulars of special "aids" available from the Association.

The Special Committee appointed to run the Campaign is presided over by Capt. J. M. DONALDSON and the members are as follows:—Messrs. H. T. YOUNG, W. C. P. TAPPER, H. BENTHAM, T. HALL, W. F. T. PINKNEY, G. H. LAKE, C. G. MORLEY NEW, C. F. WELLS, H. C. LAMB, F. H. CORSON, L. C. PENWILL, R. S. DOWNE, W. J. JONES (Electric Lamp Manufacturers' Association), F. BROADBENT (Heating and Cooking Section, B.E.A.M.A.), F. G. ALLEN (Accessories Section, B.E.A.M.A.), Miss C. HASLETT (Electrical Association for Women), Messrs. J. SNOW HUDDLESTON (Cable Makers' Association), F. W. LEEVERS (Electric Light Fittings Association), S. G. LEACH (Electrical Wholesalers' Federation), A. G. BEAVER (Electrical Merchants' and Manufacturers' Association), and Mr. R. W. KENNEDY (co-opted).

Engineering and Shipbuilding Exhibition.

A Review of some of the Exhibits of Electrical Interest.

THE tenth biennial Shipping, Engineering and Machinery Exhibition was opened at Olympia, London, on September 12th. Out of a total of about 300 exhibitors there are 60 or so directly electrical concerns, but it is probably safe to say that 90 per cent. of the displays involve the use, on show, of electrical apparatus by way of electrical drives or otherwise.

It is only possible to refer to some of the exhibits, and the following notes concern some selected items.

Instruments.

So far as novelty is concerned, there is perhaps more of interest to be seen in the various instrument displays than in any other connection.

CAMBRIDGE INSTRUMENT CO., LTD., has its usual comprehensive and interestng display, including a representative collection of instruments for ships and engineering works, including electrical CO_2 and CO indicators and recorders, apparatus for recording the percentage of dissolved oxygen in boiler feed water, draught and pressure gauges, temperature-measuring instruments, automatic temperature regulators and other instruments for engineering and electrical measurements. An interesting part of the stand is the arrangement of typical groups of instruments mounted on panels, as they would be actually installed in a vessel or power station. For example, one panel comprises two totally-enclosed indicators arranged for connection to a number of electrical distance thermometers measuring oil, water, and air temperatures throughout a turbine and condenser plant. The panel also accommodates a pressure recorder, for measuring the pressure at the stop valve boiler side, and a compound gauge for measuring the pressure at the turbine exhaust.

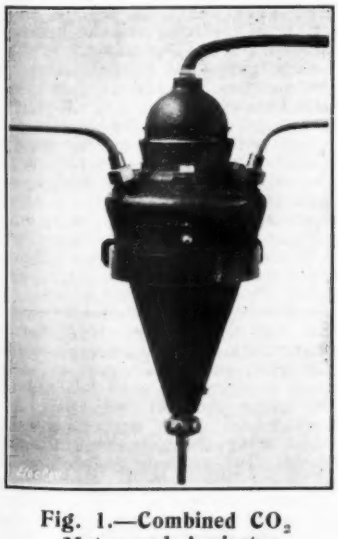


Fig. 1.—Combined CO_2 Meter and Aspirator.

Mention should be made of the latest form of combined CO_2 meter and aspirator, fig. 1, which is shown for the first time at this exhibition. The CO_2 meter is now combined together with a water-bubbler and aspirator to form a complete all-metal metering unit, which is so designed as to give accurate readings under widely varying boiler-house conditions, and is exceptionally robust and dependable. A portable instrument for giving readings of CO_2 percentage and temperature at various positions in the flues is also included in the exhibit. This instrument is particularly useful for consulting and inspecting engineers and for checking permanent installations in large power plants.

Another feature is the dissolved-oxygen recorder, a robust boiler-house instrument which records the percentage of oxygen in boiler feed water on a calibrated chart, thus checking the working of de-aerators and enabling the corrosion of boiler tubes to be reduced to a minimum. Single- or multi-point recording, indicating, or combined indicating and recording outfits are supplied, while the recorder can also be connected, if desired, to standard CO_2 and CO meters, and to a thermo-couple placed in the boiler flues, thus obtaining on the one chart records of CO_2 and CO percentage, and of the temperature of the flue gases, in addition to the percentage of dissolved oxygen in the feed water. Among the pressure recorders exhibited is a circular chart model designed for low ranges down to 4 in. of water across the chart. This low-pressure model is made in various standard ranges from 0 to 4 in. of water up to 0 to 2 lb. per square inch, draught or pressure. It is of similar appearance to the Cambridge recorders for higher pressures, and is fitted with a chart of the same dimensions, namely, 9½ in. in diameter. A combined pressure and temperature recorder combines the mechanism of a pressure recorder with a mercury-in-steel thermograph, and may be used for steam, liquids or gases. It is fitted with two pans, which record side by side on one chart, one pen being arranged to record the pressure, while the other is moved in accordance with fluctuations in the temperature as measured by a mercury-in-steel bulb. The bulb is connected to the recorder by flexible capillary tubing, which may be any length up to 50 in. The instrument can be used for temperatures between −40° and +1,000°F. (−40° and +540°C.), and for pressures or vacua between −50° and +2,000 lb. per square inch. It is calibrated to cover only the working range, thus ensuring an open scale. The charts are 9½ in. in diameter. A similar instrument is also exhibited giving two independent pressure records on one chart.

Messrs. EVERSHED & VIGNOLES, LTD., are showing a number of the marine signalling instruments which have been supplied to the Admiralty and to the merchant marine for many years, including the electrically operated helm indicator, link and valve indicator, the pulsator speed indicator, and the latest form of electrical tachometer. One of the most interesting exhibits on this stand is a working model of the Brewerton course recorder apparatus which repeats to scale on a chart the movements of a ship. There is also a full display of electrical testing instruments, including the new "Bridge-Meg" resistance tester, ELECTRICAL REVIEW, September 6th, p 415. A number of the "Evershed" chart-recording instruments having straight time lines are being shown in operation, including wattmeters, power-factor meters, and frequency meters. In addition, an operation recorder, which is becoming an important feature, not only in automatic sub-stations, but also in industrial operations, is shown working. A traction recorder, similar to that supplied to many of the leading railways and tramway services, both at home and abroad, is also being demonstrated, and a selection of switchboard and portable indicating instruments is being displayed. A feature of this exhibit is the "Midworth" distant repeater,

the purpose of which is to repeat at a distance the movement of instruments or apparatus, and it is also used for the actual remote control of distant machinery. Various forms will be shown in actual operation. Jointly with Messrs. Glenfield and Kennedy, Ltd., and the British Pitometer Co., Ltd., the "Midworth" distant repeater is on show controlling the operation of a large hydraulic valve. Another item of interest on this stand is a range of "Dionic" water testers of the portable and switchboard types.

Messrs. NEGRETTI & ZAMBRA are displaying a collection of dial-type indicating and recording instruments for temperature, pressure, and draught measurements, including dial thermometers of the mercury-in-steel type, for Diesel exhaust temperatures; recording thermometers of the mercury-in-steel distance type; recording thermometers for ships' refrigerating chambers; dial thermometers; electrical distance thermometers; thermo-electric pyrometers; dial-type tank gauges; dial-type draught gauges; and a photographic temperature recorder for cold chambers.

The last-mentioned apparatus consists of the following parts: a standard mercury-in-glass thermometer, a counter, two electric lamps, a camera, an electric motor, an electric control mechanism, and an electric control clock. The thermometer and control mechanism are mounted on a baseboard 24 in. long and 10 in. wide, suitably protected by a cover, and are placed inside the chamber. They are connected by means of an electric cable to the electric control clock, which is fitted outside the hold, the clock itself being connected to either batteries or to the ship's lighting circuit. The thermometer is mounted by the side of the counter on a metal standard which has vertical adjustment, the reason for this being that one thermometer can be utilised for a wide range of temperature and adjusted to the centre of the camera field as necessary. The metal standard carrying the thermometer is mounted at one end of the baseboard in front of the camera, and at each side of the lens is arranged an electric lamp. The camera is fitted with an extension for carrying a roll of kinema film. The electric motor and control mechanism are mounted on the board in the space between the camera and the thermometer. The motor, through the control mechanism, operates the counter, the electric lamps, the shutter of the camera, and also winds the film into position. The clock placed outside the chamber controls the cycle of operations. At predetermined intervals, every twelve hours, 9 a.m. and 9 p.m., electric contacts are made which close the circuit. A length of film is wound in position, the thermometer is illuminated, the shutter is operated, the counter advances one tooth, the light is cut off, and the cycle of operations is complete. The counter is shown in each photograph at the side of the thermometer tube to give the time scale. The film utilised is standard kinema film used lengthways, and the size of the object on the negative is slightly over natural size. The length of each image is 4 in., and for a 60-day voyage with two photographs a day and a ½ in. blank film between each photograph, 30 ft. of film is wanted.

Messrs. BARR & STROUD, LTD., have on show an interesting range of navigational range-finders, surveying range-finders, binoculars and kinematograph projectors.

The exhibit of ELECTROFLO METERS CO., LTD., is designed to show the remarkable progress in the design and arrangement of industrial instruments made during recent years. The new Electroflo multiple metering systems exhibited show the latest developments in this direction, and achieve not only the centralisation, but also the co-ordination on a 12-in wide chart of all the records by which operation is guided and plant efficiency determined. It is important to note that these records are of fluid-flow variation, temperatures, pressures, CO_2 percentages, and vacua in any required combination, and are all made electrically. The maximum number of records which can be accommodated on one recorder is six. No intermingling occurs, and the charts are electrically driven, so that there is no clock to wind. The chart lasts for approximately two months, and records over a period of 24 hours can be exposed if required.

The measurement of fluid flow is accomplished by the Electroflo system, and with the standard types of meters a 12-in. diameter circular-chart type 24-hour or 7-day recorder is employed. In the measurement of temperature and pressure a helix is used, and its movement in accordance with temperature or presure fluctuations causes a contact arm to move over a continuous resistance. This resistance is part of an electric circuit which includes the recording movement. The variation in resistance causes a corresponding movement in the recording pen, and results in a sensitive record of temperature and pressure fluctuations. CO_2 analysis is accomplished with the Electroflo motor-driven analyser which is exhibited. This instrument is virtually an automatic Orsat apparatus, and is independent of water, and operated by a 1/20th h.p. motor, with all the driving and measuring mechanism continuously oil-immersed. The caustic capacity permits four to six months' operation, dependent upon the amount of CO_2 absorbed.

The Electroflo multiple draught indicator offers the advantage of ready comparison of related draught and pressures, and occupies far less space than single instruments for the same number of points. The principle of operation is extremely simple, the suctional pressure to be measured is applied to the inside of an oil-sealed bell, whilst the atmospheric pressure acts upon the exterior. The bell rises or falls in accordance with the difference between the internal and external pressures, the amount of movement being controlled by a weight. This movement is magnified and transmitted to a pointer moving over a long, straight vertical scale.

Messrs. GEORGE KENT, LTD., are displaying the "Kent" combustion efficiency meter, fig. 2. The basic principle of this instrument lies in the assumption that the efficiency of a boiler remains constant at all loads; hence for correct efficiency the quantity of air supplied to the furnaces should be proportional to the evaporation. The meter consists essentially of two primary parts:—a steam-flow meter giving the output of the boiler; and an air-flow meter giving the air supplied to the furnace. A link mechanism combines the motions of the steam meter and the air meter, so as to give the ratio of the two, which is indicated by the pointer on the scale labelled "Combustion." This pointer is so arranged that when the correct ratio of steam output obtains, the pointer reads zero. A movement of the pointer to the right indicates an excess of air, and to the left a deficiency. The setting of the pointer so that its zero indication is correct is done by hand after a flue-gas analysis has determined the correct ratio. A diagram is provided giving a record of the steam flow in the centre portion, and a record of the air to steam ratio in the outer portion. It is thus possible for the engineer to determine whether correct air conditions have been maintained during the various shifts. There is also given on the chart a record of the flue-gas temperature, this being operated by a nitrogen thermometer. At the bottom of the meter panel a flue draught indicator is provided.

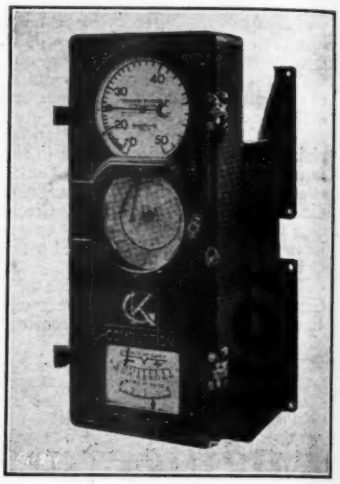


Fig. 2.—Combustion Efficiency Meter.

On the stand of the DRAYTON REGULATOR & INSTRUMENT CO., LTD., may be seen a complete range of automatic temperature and pressure regulators, temperature and pressure recorders and dial thermometers. Most of the temperature regulators shown are arranged for demonstration. Interesting exhibits are time-temperature regulators for following out pre-determined temperature cycles, humidity regulators, differential humidity regulators, pressure regulators and flow regulators. Exhibits by this firm of special interest to the electrical industry are temperature and pressure-operated switches and contactors, and cylinder-type pressure regulators suitable for controlling the shunt regulators for varying the speed of pumps.

Messrs. KELVIN, BOTTOMLEY & BAIRD, LTD., are displaying the latest models of "Kelvite" navigational specialities, and also a number of new developments for marine use. A range of magnetic compasses for the mercantile service include the original Sir William Thomson Light Card compass, the "Kelvite" standard compass embodying Lord Kelvin patents, a vertical card liquid steering compass, and also a liquid steering compass with a reduced diameter card and internal magnifying device, besides compasses for yachts and other small craft. Various types of compasses for naval and air service requirements are also exhibited. In this section are submarine projector binnacles and new designs of compasses with quick dead-beat action for all classes of aircraft. With regard to apparatus for taking soundings, the "Kelvite" heavy-duty motor sounding machine, designed to meet the requirements of very fast vessels, should merit special attention. A new type of sounder operated on acoustic principles is shown, and also a sounding machine for submarine craft, in addition to the standard "Kelvin" models. Among other exhibits of special interest by this firm may be mentioned the "Denny-Edgcombe" direct vision torsionmeter, a new and robust mechanical form of torsionmeter specially designed to withstand the onerous conditions in a propeller shaft tunnel; the K.B.B. pneumercator tank gauge; draught indicator; and a distant reading boiler water-level gauge, actuated on the pneumercator principle, which brings the water-level indicator down to the firing floor level. The gauge is operated under cold-water conditions, and is specially suitable for modern high-pressure boilers. A new departure of Messrs. Kelvin, Bottomley & Baird is a range of medical apparatus for the ship's surgery and hospital. This includes a K.B.B. shadowless operating lamp arranged for use on shipboard, an apparatus for sterilising drinking water on an adequate scale by means of ultra-violet radiation, lamps for radiant heat and artificial-sunlight treatment, and a portable X-ray outfit.

Batteries.

Storage batteries covering a wide range of marine purposes are included in the exhibit of the CHLORIDE ELECTRICAL STORAGE CO., LTD. An "Exide-Ironclad" battery for yacht and marine work is displayed in a "cutaway" which shows the sectional construction. Another notable exhibit is an "Exide-Ironclad" cell of the very largest size, as used for

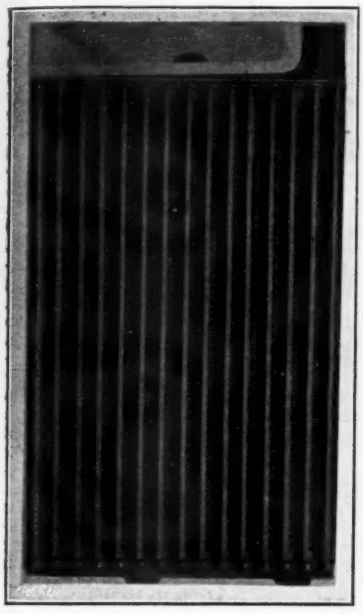
the propulsion of submarines. This type of battery possesses certain unique features which enable it to function successfully under conditions involving heavy electrical discharges, continuous mechanical vibration, and swirling of the electrolyte. In the positive plate the active material is enclosed in slitted ebonite tubes, and is thus held securely in contact with the grid which conducts the current to the terminals. The slitting of the ebonite is of such a fine nature that the electrolyte is allowed free diffusion to the active material, but the latter cannot fall away from the tube The plate is thus maintained in a constant state of maximum efficiency. Figs. 3 and 4, respectively, show the positive and negative plates. A range of batteries in celluloid and in glass containers for wireless purposes and other comparatively light duties is displayed. It includes a series of unspillable batteries in which an unspillable device or acid trap renders them proof against any loss of acid under the most severe conditions of shaking, tipping or even complete inversion. "Mass"-type cells, specially designed for long slow or intermittent discharges, are particularly serviceable in cases where recharging is only necessary at infrequent intervals, as in operating electric clocks, bells, telephones, alarms, and signalling circuits. The plates are of unusual thickness, embodying a thick mass of active material in a very simple framework or grid. The batteries will stand and hold their charge, and when not in use can be left without attention, even though partially discharged, for long periods without suffering any detriment. On one charge they will usually outlast the complete life of a dry or primary battery.

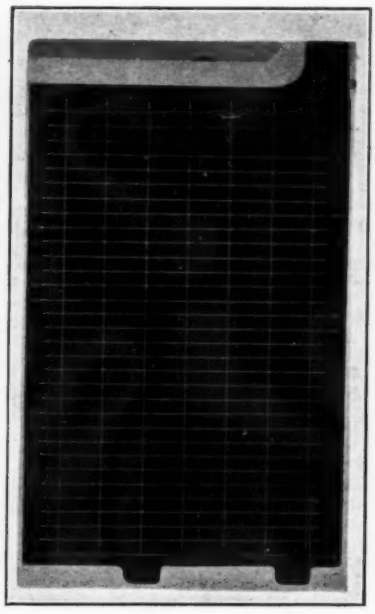
Stationary batteries for such purposes as yacht lighting, the operation of gyroscopic compasses, and the electrical propulsion of small craft are also displayed. There is also an actual demonstration of the new "Keepalite" system for supplying emergency current when the ordinary supply fails. Typical applications are emergency lighting and the supply of essential circuits, as in the emergency operation of steering-gear motors. Should the ordinary supply fail, a change-over contactor switch automatically and instantaneously switches on the auxiliary supply from the battery, which, when not in use, is maintained always fully charged and in good condition by a very small continuous "trickle" charging current.

The following notes refer to the "Nife" products displayed on the stand of BATTERIES, LTD. "Nife" steel-plate accumulators eliminate the use of lead and acid, using in their place steel plates immersed in a non-corrosive alkaline solution. Consequently the cells can stand long periods of idleness without deterioration, and are not damaged by overcharging. Cells of this type also have no self-discharge. A special feature is the inserted corrugated strip which is now fed into the pockets of active material in "Nife" cells. The effect of this conducting strip in the pockets is to reduce very materially the internal resistance of the cells, thus keeping the voltage up, even under very heavy discharge rates. Fig. 5 depicts the construction of the cell. There is an exhibit of "Nife" cells as used with emergency steering outfits for Diesel ships. These cells are of the special low resistance type to cope with the heavy discharges met with when the rudder is "hard over." They are also provided with specially high electrolyte space to minimise topping up.

A complete range of "Nife" marine lighting batteries is shown, either for use as main installations or for local standby in the case of engine-room failures. There is also a selection of "Nife" batteries for electric trucks and locomotives, specially designed to withstand the severe vibration of this service. A feature of special interest is the exhibit of cells as supplied for automatic sub-station work and switch closing in connection with the national "grid" scheme.

A variety of handlamps, including special gas-proof lamps for oil tankers, is shown, and there is also an exhibit of the "Nife" Admiralty pattern handlamp cell as standardised throughout the British Navy for handlamp requirements. "Nife" portable searchlights and signalling lamps are also exhibited.





Figs. 3 and 4.—"Exide-Ironclad" Positive and Negative Plates.

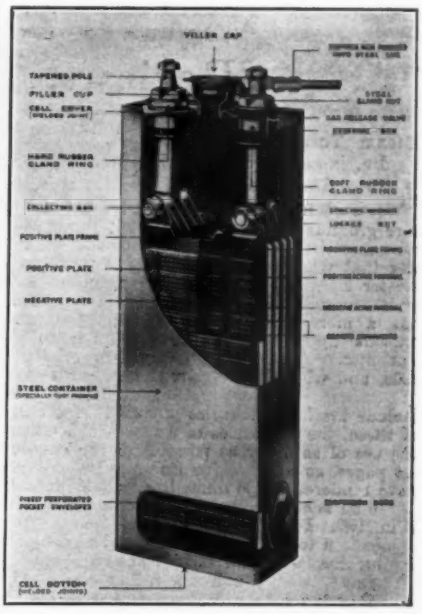


Fig. 5.—Construction of "Nife" Cell.

The EDISON SWAN ELECTRIC CO., LTD., is showing ranges of "Royal Ediswan" lamps and "Edison Swan" cables, in addition to the "Ediswan" house-wiring systems and "Ediswan" stationary batteries.

EDISON ACCUMULATORS, LTD., are exhibiting their all-steel batteries. It is interesting to note that this year, for the first time, they are in a position to book orders for British-made "Edison" accumulators. Owing to the many economic disadvantages connected with the importation of Edison accumulators from America, it has been the desire of the company to manufacture the "Edison" nickel-steel accumulators in this country, and since the obstacles in the way of carrying out this project have now been overcome, they have equipped a large factory at Redditch with up-to-date plant for the manufacture of the batteries.

Domestic Appliances.

BERRY'S ELECTRIC (1928), LTD., are showing heating apparatus of the "Magicoal" fire type suitable for ships' cabins and state rooms. The feature in connection with all models is the small projection; even the large "Adam" fireplace, fig. 6, has only a total projection of 10 in. It has a 3-kW

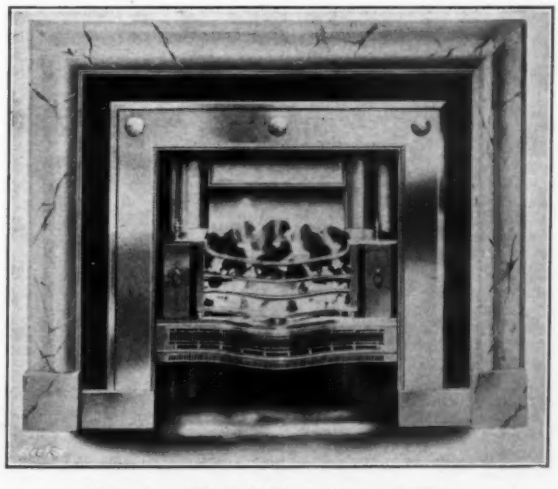


Fig. 6.—Three-kW "Adam" Fire.

loading. This company is also showing cabin heaters, which are made in two types for deck mounting or for screwing to the bulkhead. The heating is 1-kW black heat, and is arranged so that if a coat or any other article is thrown over the element it will not catch on fire. In addition to heaters, on this stand are also displayed some examples of "Ironclad" switchgear.

ELECTROLUX, LTD., have their usual very attractive display of products, including the cleaner, refrigerator and floor polisher.

(To be continued.)

Reviews.

Steam Turbines. By JAMES A. MOYER. Sixth Edition. Pp. ix+557; figs. 250. London: Chapman & Hall, Ltd. Price 22s. 6d. net.

When a book reaches its sixth edition, there are obviously very sure grounds for suggesting that it fulfils a definite need. At the same time, as edition succeeds edition, there is always the risk that while every endeavour is made to keep the subject matter right up-to-date, undue prominence is given to more or less obsolescent matter while, in any case, the final result has a more or less patchwork appearance. Both of these truisms apply with particular force to Moyer's "Steam Turbines." The first edition, it may be noted, appeared in 1908, and while it is apparent that great care has been taken to deal with the more recent designs of turbines, as well as to include the latest theories governing the design and operation of these, the exigencies of a new edition, involving as it does the use of as many as possible of the existing blocks and the set pages, as distinct from a complete re-writing of the book, have rendered it too difficult a task to produce a treatise dealing in an adequate manner with the steam turbine as we know it in 1929. During the last decade, particularly in so far as its application to the driving of electrical generators is concerned, the turbine has advanced by leaps and bounds, both as regards size and efficiency, and it is rather disconcerting, therefore, to find that the author in that section of his work dealing with "commercial types of turbines" deals mostly with units of less than 10,000 kW output, only the briefest reference being given to the larger sizes, including two illustrations of a Westinghouse 165,000-kW turbine. But from these the reader can only obtain the haziest notion of modern turbine practice. Again, in a very valuable chapter entitled "Steam Turbine Economics," the table showing the development of power plant units is not carried beyond the year 1924, despite the wealth of suitable data which is available, both in the technical Press and in the transactions of our technical institutions. It is to be noted that the book is of American origin, and, therefore, the figures relating to costs, &c., in this chapter differ substantially in many respects from those which would obtain in a British power station. Nevertheless, this chapter is one of the best in the book, because it is rare to find this most important phase of the question dealt with at all.

We have dealt at sufficient length with the limitations of this book, limitations which, in justice to the author, we assert are inseparable from the sixth edition of a treatise on a subject developing so rapidly as the steam turbine, and it is with pleasure that we turn to the many features which command our appreciation. From the points of view of the student and the draughtsman, we commend the chapters dealing with the design of the various parts of a turbine, such as the blades, nozzles, disks and shafts. These are very clearly set out, and a number of numerical calculations add value to the explanations which, as far as possible, are made with a minimum of advanced mathematics. The calculations for the design of a reaction turbine are given as an appendix, but it is to be regretted that in these days of large units, these calculations should apply to a unit of 300 h.p. only. The power station engineer will appreciate the chapters dealing with turbine tests and the methods of correcting the results of such tests, so as to bring them down to some standard steam conditions as a basis of comparison, although we might suggest that these two chapters could be brought together in a future reprint of the book, instead of being widely separated as at present. We are, perhaps, too often inclined to regard the turbine as a prime mover, the use of which on land is restricted to the electricity generating station, and it is of interest to note that the author devotes a considerable amount of space to the steam turbine for industrial power plants. While such turbines are nearly always employed to drive electric generators, the particular conditions which obtain in the works often permit of the use of special types of turbine, rather than the usual "straight through" turbine of the central station. These special types, such as mixed-pressure turbines, reducing-pressure turbines, bleeder turbines, and so on, are described at length together with the economic advantages which follow their adoption. This is a valuable feature of the book, and it deals with a phase of turbine design which has not received the attention it merits in this country.

It will be realised from the foregoing that while it suffers from numerous defects, this book is one which can be recommended, not only to the student, but also to the engineer. The former will find that it deals in a succinct yet comprehensive manner with every type of turbine, as well as the general principles underlying their design and operation, while the latter will doubtless discover much within the compass of its 557 pages which will help him to a better understanding of his work.

Practical Geometry and Engineering Graphics. By W. Abbott, B.Sc., A.M.I.Mech.E. 8¼ in. × 6 in. × 1¼ in. Pp. 304; illustrated. London: Blackie & Son, Ltd.. Price, 10s. net.

Geometry, as the term is understood to-day, is one of those subjects which may be said to stand mid-way between the theoretical and the practical. A few years ago the boy at school had to wade through the various propositions contained in such of Euclid's books as had escaped destruction, and this subject was called Euclid; to-day the less abstruse—or, shall we say, the more useful—of Euclid's propositions have been selected and arranged in more or less logical sequence, and the study of these, together with the corollaries, riders, &c., which can be deduced from them, constitutes the subject known as Geometry. This subject, which is purely theoretical and abstract, contains certain propositions which form the basis of various geometrical problems used by engineering draughtsmen and architects in the exact production of their drawings, and it is the numerous applications of these propositions, together with various others, which find no place in the known books of Euclid, which form the basis of practical geometry. A knowledge of practical geometry may be regarded as essential to the engineering designer and draughtsman, and the senate of the University of London has recently recognised this fact by including a greater amount of geometrical drawing in the syllabus of the subject, "Engineering Drawing and Design," which forms a compulsory part of the examination for the intermediate B.Sc. in engineering. Moreover, the application of graphical methods to the solution of numerous problems in engineering science, notably in electrical engineering in the study of the theory of alternating currents, calls for an extensive knowledge of geometrical drawing, so that the engineering student who has ambitions to occupy a position other than that of a draughtsman or a designer, must make a study of practical geometry and engineering graphics.

The book under review strikes a new note in that it essays to deal with the subject of geometrical drawing from the point of view of the engineering student. The author divides his subject into two parts, the first dealing with plane geometry and engineering graphics—this latter, presumably, coming under plane geometry, since only vector quantities in one plane are dealt with—and the second with solid or descriptive geometry. The author recognises, however, that it is a difficult matter to obtain any logical sequence in a composite subject such as this, and suggests that both parts might be studied concurrently. Each part is subdivided into a number of chapters, and each chapter, the commencement of which might have been more clearly indicated, consists merely of a number of problems set out on the left-hand pages, the corresponding solutions being given on the right-hand pages immediately opposite. Unfortunately, only the method of solving the problems is given, no attempt being made to give reasons for the particular construction employed. This, we think, is rather to be regretted, because the knowledge of the reason for any particular method of construction, apart from its intrinsic value, often supplies the key to the solution, and can be much more readily memorised. We recognise that to have given the proof of all the problems might have increased the size of the book, and with it the price, this latter being commendably low, but since some elementary knowledge of practical geometry, graph plotting and the use of vectors is assumed, certain of the more elementary portions of the subject might with advantage have been omitted in favour of a brief explanation of the *raison d'être* of the construction, and the size and cost kept as at present.

Apart from this reservation, we have nothing but praise for the able manner in which Mr. Abbott has performed his task. He has covered a very wide ground, including in the ten chapters of the first part of his work such widely separated branches of plane geometry as general problems of the straight line and circle, other conic sections, wheel teeth, sine and cosine graphs, simple harmonic motion, loic, cams, velocity, and acceleration diagrams for mechanisms, harmonic analysis, graphical differentiation and integration and graphical statics, this latter including shearer-force and bending-moment diagrams for beams, and forces in braced structures. In the nine chapters of the second part we have less that is of direct value to the engineer, but all the usual problems of solid geometry are adequately covered, including sections, intersections, shadows and development of surfaces, while, in addition to orthographic projection, isometric projection, as well as certain of the lesser known systems, are illustrated. We may add that numerous examples are interspersed throughout the book dealing with the problems which they follow. We welcome this book as ably filling a long-felt want, and we recommend it with confidence, not only to the engineering student, but also to the draughtsman, the designer, and the consulting engineer, feeling that these latter may regard it as a work of reference, the index enabling any of its 343 problems to be readily located.

Association of Public Lighting Engineers.

Annual Conference and Exhibition at Bournemouth.

ON Monday last the annual conference of the Association of Public Lighting Engineers commenced at Bournemouth. The proceedings began with a reception of the delegates at the Town Hall by the Mayor of the town (Alderman C. H. Cartwright, J.P.), who afterwards formally opened an exhibition of street lighting appliances, some notes on which follow. On Tuesday the members assembled at the Town Hall under the chairmanship of Mr. J. F. Colquhoun, the president, when they were addressed by the Mayor, who welcomed them to Bournemouth. The president having responded and thanked his Worship, introduced his successor in the office of president, Mr. S. B. Langlands, J.P., Lighting Inspector, Glasgow. After a diploma had been presented to Mr. Colquhoun and formal business transacted, Mr. Langlands delivered his presidential address, an abstract of which is given below. The next item on the agenda was the reading and discussion of a paper by ex-Bailie J. MacDougall (Glasgow) on "Lighting and Rating," which is also reproduced in abstract form. The delegates then adjourned for luncheon at the invitation of the Bournemouth Gas and Water Co., Lt.-Col. Sir Charles L. Morgan, C.B.E., Past-President of the Institution of Civil Engineers and deputy-chairman of the company, presiding.

After luncheon the conference re-assembled to hear a paper on "Compromise in the Use of Illuminants for Public Lighting," by Mr. C. H. Woodward, Lighting Superintendent, Bournemouth, and a discussion followed.

On the following morning (Wednesday) the President, accompanied by the Council and members, placed a wreath upon the Borough War Memorial, and the delegates then proceeded to the Town Hall for the reading and discussion of a joint paper by Messrs. J. F. Colquhoun, City Lighting Engineer, Sheffield, and Mr. E. J. Stewart, M.A., B.Sc., Assistant Inspector of Lighting, Glasgow, on "American Practice in Public Lighting." Subsequently Mr. J. S. Dow read a paper on "Private Lighting as a Supplement to Public Lighting." The adjournment for luncheon followed the discussion of this paper, and the transaction of certain formal business. In the afternoon the members reassembled at the Town Hall for the inspection of the exhibition of appliances. The annual dinner took place in the Town Hall in the evening. Yesterday (Thursday) was to be devoted to pleasure trips, a number of excursions having been arranged.

President's Address. (*Abstract.*)

By S. B. LANGLANDS, J.P., President.

I am presiding over your meeting through the passing of two splendid colleagues, Dickenson, of Liverpool, and Wright, of Bournemouth.

We are now about six years old and have the support of four honorary, one hundred and four ordinary, thirty-five junior members, twenty-six associates, and the delegates at our annual meetings of corporation members from the various cities.

We are a corporate body with growing funds. We have enjoyed recognition of our work by kindred associations and by the public authorities controlling public lighting throughout the country. Our representatives on the British Engineering Standards Association Committee on Street Lighting were assiduous in their efforts to keep practice and theory as partners, not rivals.

Again, our representatives on the International Illumination Commission expressed our Association's views and outlook to our complete satisfaction.

At this point I would like to remind you of the visit of the I.I.C. to Britain in September, 1931. Last year our American cousins showed us what organisation with a true desire towards hospitality can do towards success. We can certainly show those visitors our lighting outlook, which is in many cases so essentially different from theirs, our staid conception of our lighting duty to each and all of a town's or city's inhabitants as contrasted with their sometimes excessive lighting of show streets and meagre lighting of by-ways.

What are our street lighting ideals? Is the Standard Specification our entire answer? Well, it is certainly enough to be going on with for improving the streets at night in our various towns, but many other things will be needed by each city lighting engineer if progress is to be made. I cannot conceive of any public lighting department not having a well-equipped testing section if not a complete research laboratory. I can assert confidently that Glasgow Lighting Department laboratory has been invaluable to us and has saved the City and is saving money continuously. Instead of empiricial hit-and-miss methods, we predetermine the value of all materials to be used —burners, mantles, bulbs, lanterns, cables, &c. We bring in materials after they have been in use and determine deteriorations, and try to solve problems—arising in our routine work—of physical change of condition of plant. We are experimenting just now with electrical relays, as I can foresee the time when the lighting and extinguishing of a city's lamps will be done from one or two divisional stations, and those stations will be more like the engine room of a ship than a muster hall for lamplighters. We have chosen one big housing area for initial experiment and intend to build the station this season. The relay we are at present using.

Another idea, and I am giving it in its crudity, is the method of laying supply cables for our work. [The cables are shown in a sketch to be laid under the kerb in a pitch bed and teed to a fuse in the base of the lamp pillar.—Eds.] Accessibility and safety are my claims for this method, and although one of my electrical engineering friends has damned it and me, not with faint praise but with dissuaders almost as sure as bell, book and candle, I want it tried. Our city streets are a burying ground that is getting overcrowded, and you cannot keep trouble underground by concrete roads or concrete founds for bitumen surfaced roads.

I know the many objections that will be urged—the difficulty of insulation and therefore danger, the possibility of excessive dampness and junction difficulties at street intersections. The street engineer may object to his kerb being used, then attach my idea on to and behind the kerb. Nothing was ever yet suggested, if it was worth trying, which did not, by its own inherent merits, overcome its own created difficulties. It may be that the whole matter of the ventilation of the soils beneath city streets will ultimately have to be tackled and that lighting department pillars, when of sufficient heights, will be used as ventilating shafts with extractors atop.

The question of tariffs for gas and electricity could well form a topic for a vigorous discussion at our meetings. The prices we are charged vary so greatly in each city and town.

Our electrical friends have set up a Tariffs Committee; might I modestly suggest that the prices charged for public lighting have their early attention, and also that a standardisation of the charge for places having 100,000 of population at a price below 1d. per unit should seriously be considered? Most of our current is consumed during quiet hours, and we are possibly *the* most regular and consistent consumer they have got. It might be worth our while to set up a small committee to watch our interests in this matter.

There is one appeal I want to make to those in charge of public lighting. Give maintenance of plant first place in your every-day thoughts. Do not exact too much from your material, rather be satisfied with 1,000 effective hours than 1,500 eventually defective hours.

Should we not have a Committee to test and assess the value of new ideas, the convener of that Committee to distribute around those cities having well-equipped testing stations any gear discovered, and the results of the tests to be ultimately the property of all our members? None need be afraid of the testing station if the article submitted has intrinsic worth, and this brings me to my final words, in which I would commend to your attention the Exhibition which is being held in the adjacent hall.

I would ask you, for instance, to examine carefully the exhibits which take advantage of the physical behaviour of selenium. This metal reacts according to the amount of light it receives. There are interesting possibilities here—a problem for my suggested research committee.

It is a matter of regret that in the Royal Commission's first report on the Control of Traffic on Roads no pronouncement was made on the need for complete reflective lighting of thoroughfares. When enactments emerge as a result of the labours of this Royal Commission, our Association will require to carefully watch their provisions, and it might be well if a small sub-committee, say three members of the Council, were appointed now for this purpose.

The duties of a city's lighting engineer are increasing daily. The care and maintenance of police signals and of traffic signs and controls, and the care and maintenance of city clocks are already part of our duties in Glasgow (in conjunction, of course, with other chief officials), and if the proposal to illuminate street name tablets and street numbers receives support, then the number of lighting points to be maintained will be greatly increased. We may be asked to plot out lighting schemes for new public buildings. Our work has of necessity to be done in conjunction with the work of other public departments, and we must try and get them to realise that they can assist us in many ways.

Lighting and Rating.

By Ex-Bailie JAMES MACDOUGALL.

(*Abstract.*)

The majority of the cities and towns in Great Britain are simply playing with the question of street lighting. From figures recently collected by Mr. J. F. Colquhoun, of Sheffield, which I take the liberty of printing, the expenditure per head of the population per annum is given as :—

	s.	d.
Leeds	4	4
Glasgow	4	2
Manchester	3	6
Newcastle	3	4
Dundee	3	4
Liverpool	2	9
Leicester	2	7
Edinburgh	2	5
Aberdeen	2	4
Sheffield	2	4
Birmingham	2	2

It will be seen that only two cities spend a sum of 4s. per head of the population per annum on street lighting, while in a number of cities the amount does not exceed 3s. A recent writer in an American journal states that no progressive city should be spending less than two dollars per head per annum on this service.

The present average practice for the lighting of side streets in Glasgow is to use 2.8 cu. ft. burners, mounted at 10 ft. 6 in. and spaced 25 yards apart. In main streets which are awaiting improved lighting there are 6.75 cu. ft. 4-light burners, mounted and spaced as for 2.8 cu. ft. units.

To provide a proper standard of illumination, it would be necessary to increase the 2.8 cu. ft. units to 10 ft. 4-light burners, this necessitating a larger lantern and increasing the mounting height to 13 ft. 6 in., but no change would be necessary in the spacing. The main streets would require the replacement of the present 6.75 cu. ft. burners, 10 ft. 6 in. high and 25 yards spacing by 500-watt lamps on steel poles giving a mounting height of 22 ft. at 40 yards spacing. To do this would mean an initial expenditure of £133,500 and an additional annual cost of £87,000, requiring a lighting rate for Glasgow of at least 10d., the present limit being 9d. in the £.

The lighting rate for the year 1927-28 was 8.97d., and this rate was only obtained because of the exceptionally heavy expenditure on new lighting in housing schemes and the absolutely necessary improvement of the lighting of arterial routes.

On the question of rating the following figures will, I think, prove of interest :—

	Population.	Ratable Value.	Value Per Head.	Product of 1d. in £ Rate.	Total Rates.
		£	£ s. d.	£	
Glasgow ...	1,034,174	11,599,163	11 4 3	43,000	14/0.3
Birmingham..	955,300	6,689,011	7 0 0	25,472	14/6
Bradford ...	293,200	2,548,035	8 13 10	9,856	14/2
Leeds ...	483,952	3,386,257	6 19 11	13,234	15/8
Leicester ...	245,000	1,504,000	6 2 10	5,858	14/11
Liverpool ...	875,900	7,246,549	8 6 0	25,423	14/9
Manchester ...	751,900	7,015,912	9 6 7	27,300	13/4
Newcastle ...	288,500	2,449,923	8 9 10	9,508	12/5
Sheffield ...	524,900	2,620,155	4 19 10	9,872	18/8

From this you will see that Glasgow stands well ahead with the highest ratable value per head of the population as also the highest product from the 1d. in the £ rate.

The securing of a separate lighting rate is a very necessary first step towards bringing the needs of public lighting before the community, and in this connection lighting engineers would do well to avail themselves of every opportunity of presenting such a case to the Parliamentary Bills Committee of their local authority. So far as my knowledge goes all expenditure for public lighting in the United Kingdom is met from assessments.

A glance at the expenditure of any lighting department shows three outstanding items—labour, gas and electricity. The extent to which the manual element can be eliminated in the actual lighting and extinguishing depends of course on the illuminant. With gas the pressure wave method is, I think, of limited application and not in operation in any large town where the gas is supplied from various works.

The clock controller for single lamps has now reached a high state of efficiency, but again where the law enacts that the lighting authority "shall light," it is essential that the lamplighter shall cover the area for which he is responsible so that he can speak of having seen the lamps lit. If this inspection is carried out then I fear the saving by the use of mechanical lighters will be negligible.

With electricity, certain conditions prevailing, I think the position is somewhat better. In Glasgow, where special lighting cables are laid, or run overhead, the relay system becomes a possibility, and permits of large areas being linked up.

Gas prices for street-lighting, ranging from 11d. per 1,000 cu. ft. in Sheffield to 2s. 4d. per 1,000 cu. ft. in Glasgow, suggest that here we have a splendid field for the operations of the B.C.G.A. When dealing with gas, I think we must of necessity include mantles, on which Glasgow last year spent over £5,000.

Electricity offers for street lighting purposes at least the tempting price of ½d. per unit, a decided improvement on the 1½d. at present being paid by Glasgow.

But as the gas industry cannot afford to ignore the mantle question, so the electrical industry must see to it that the price of lamps does not prove a stumbling block.

It seems to me that the manufacturers of lamps are hard put to it to explain the unusual difference between the prices prevailing in America and in this country :—

60 watt : 1s. to 1s. 3d. against 2s. 3d.
100 watt : 1s. 5½d. to 2s. against 4s. 3d.*

Surely we can hope for a contribution from this source.

The Exhibition of Lighting Apparatus.

As has been the custom at the Conferences of the Association during the past few years, this year at Bournemouth a display of street-lighting equipment of all descriptions was held. A dozen or so electrical firms took part in the very creditable show, and the following notes concern some of the more interesting items exhibited :—

HOLOPHANE, LTD., showed a complete range of directional prismatic refractors for street lighting. This range has been augmented, so that it now forms a most complete series to meet every street-lighting problem. The bowl refractors are obtainable in six types, each type being made in various sizes for different wattage lamps, so that a comprehensive system may be installed with due regard to street crossings, intersections, open spaces, squares, &c. The six different types are as follows :—symmetrical—for open spaces; asymmetrical—for one side of the road lighting or for wide roads; 2-way non-axial—for side of the road lighting between intersections; 2-way axial—for central suspension between intersections; 3-way non axial—for T-intersections; and 4-way axial—for 4-way intersections.

Fig. 1.—"Holophane" Refractor Lantern.

Further to the above series, the "Holophane" dome refractors have been developed, and now, in addition to the symmetrical, 2-way and asymmetrical types are obtainable.

The band-type refractors are now being made in the symmetrical and 2-way non-axial types. For promenade and park lighting a new ornamental type of unit of imposing appearance has been designed. This is also made in two types to give either a symmetrical distribution or an asymmetrical distribution. In addition to such a complete series of street refractors, the lanterns used with them have also been improved; in particular provision is made for external lamp focusing.

The "Holophane Spot-O-Lite," the latest development in spot projectors, has aroused considerable interest among illuminating engineers. The projector embodies an entirely new optical system of far greater efficiency than older designs working on the "Magic Lantern" principle. The diameter of the beam is controlled by a lens system of variable power which can be adjusted to project different sizes of spots within wide limits. The scientific control of light flux is demonstrated by the unique feature that the intensity of illumination rises

* Mr. MacDougall's prices are not quite up-to-date. The standard voltage clear gasfilled lamps are now priced as follows :—100-W, 4s.; 60-W, 2s. 3d. "Pearl" lamps can be obtained at 3s. 6d. for the 100-W and 2s. for the 60-W (a penny lower for 230 V).—EDS. ELEC. REV.

as the degree of concentration is increased and the size of spot thereby reduced. Spreading lenses and masks of special shape can be supplied to order, so that the "Spot-O-Lite" can be arranged to project a beam to exactly coincide with the object to be "spotted." A range of colour and artificial daylight screens can be supplied. Besides its uses in interior illumination, by reason of its efficiency and being waterproof, the "Spot-O-Lite" has found considerable application for the illumination of public clocks, notices, &c., and has also been applied to the spotlighting of point-duty policemen. Fig. 1 shows a "Holophane" refractor lantern which was among several items of the same make shown for the first time at Bournemouth. The refractor is of the bowl type, and the lantern is one of the company's cast-iron series.

Among several interesting items seen on the stand of the ENGINEERING & LIGHTING EQUIPMENT CO., LTD., was the "Glasgow" fitting, with a two-way directional band-type refractor. The chief points concerning this fitting are that the case is easily lowered away by phosphor-bronze toggles, thus giving ready access to the interior, the fitting is suitable for lamps up to 1,500-watt, and the inlet and outlet ports are carefully balanced to avoid any stifling of the air currents.

The "Trent" fitting which was shown is a similar one, with a vitreous-enamelled case, and is suitable for lamps up to 500-watt. Other items of interest were new designs of the "Greenock White-Way" fitting. One has an ornamental double bracket, suitable for fixing on top of cast-iron columns of 12-14 ft. high, and for taking two 200-watt lamps in the normal downward position. Another type of "Greenock" is the ornamental pole clamp-bracket type. It is interesting to note that the "Greenock" units have been supplied to the following towns in South Africa: Cape Town, Johannesburg,

Fig. 2.—"Empire" Lighting Unit.

Fig. 3. "Radiovisor" Unit and Bridge and Relay on P.L. Standard.

Bulawayo, Durban, and Bloemfontein. For side-street lighting, ornamental bracket fittings of Nos. 253, 439, 375, and 224 designs were among this firm's exhibits. Engineering and Lighting Equipment Co., Ltd., also exhibited for the first time a new range of "Empire" enclosed units, fig. 2. A new design of time switch was also a feature of the exhibit.

MUNICIPAL SUPPLIES, LTD., displayed some interesting copper street lamps, as well as a range of hospital and workshop daylight electric lamps of the latest type. A small, handy, collapsible ladder, suitable for a cyclist fixing to his machine, and yet sufficiently strong to allow him to reach the ordinary street lantern and regulate any mantle, was another item displayed on this stand.

The WARDLE ENGINEERING CO., LTD., displayed a representative range of street-lighting equipment which included lanterns with both plain and directive glassware, brackets for pillar and pole mounting, watertight boxes incorporating control gear of the various types in demand, open-type reflectors of the single- and multiple-lamp patterns, and a selection of accessories for counter display. The "Bruce" lantern was also a prominent feature of the display. This design should be of special interest to lighting engineers generally, and in particular to those who have to contend with rigorous atmospheric conditions.

Attention might also be directed to the "Prismat" directional bulkhead fitting which has been designed to direct the light in any desired direction. It is recommended for the lighting of tunnels, subways, and other situations where previously the ordinary bulkhead fitting has sufficed.

VENNER TIME SWITCHES, LTD., had on show a full range of "Venner" time switches designed for street-lighting control, both hand and electrically wound types, and also examples controlled by the "Venner" solar device. Switches for individual posts, small groups, and heavy-capacity switches for controlling large groups were also shown. Special switches designed for the General Post Office Authorities (electrically wound and solar dial controlled) for use in new telephone kiosks to control the lighting therein attracted considerable attention on this stand. Other "Venner" products displayed were relays of different types and capacities, including a special type designed for New Zealand; a special street-lighting switch designed for the Hague Municipality; a time switch with a synchronous motor; enlarged models of electric wind motors and solar dials; clock parts and stop watches; diagrams of solar curves; and a complete range of boxes for housing street lighting switches of all types and designs.

Several types of street-lighting units, including the "Nile," "Spherical," and "Brighton" types, together with various works—lighting fittings of the focusing, angle and dispersive types, were shown on the stand of METRO-VICK SUPPLIES. In addition, a selection of commercial-type "silverstone" units was displayed, and two types of fittings recently introduced

Fig. 4.—"Silvalux" S.L. Fitting.

for hospital lighting. Met-Vick "Floodray" projectors were also included in the exhibit. These represent a distinct advance upon earlier models, and are built with a view to providing a lighting unit giving ample and evenly diffused illumination conjointly with high efficiency and mechanical strength.

The exhibit by SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., comprised a range of fittings for street lighting and for the illumination of public halls, &c. Amongst the street-lighting fittings was the "Silvalux," fig. 4, designed for use with Siemens "Silvalux" opal gasfilled lamps. The illumination on the street level is very even, and there is entire absence of glare, due to the fact that the whole of the bulb operates as the source of light, and in addition the diffusing properties of the opal bulb improve considerably the light distribution in a horizontal direction. The fitting consists of a cast canopy surmounting a vitreous-enamelled reflector of a special curvature designed to assist in the distribution of light at an angle of approximately 15 deg. below horizontal. This type of unit affords an excellent method of street lighting at a relatively low expenditure, the fitting being cheap in first cost and the maintenance expenses very low.

The "Siemens" exhibit also included the following:—The "Ultralite," an entirely new enclosed lighting unit making use of a glass canopy in place of the usual metal one; "Heliolux" fittings, comprising a new range of moulded-glass lighting units of a more decorative nature than the plain "Silvaray" fittings; a new fitting—the "Eralite," daylight enclosed unit, which is designed to give illumination approximating to natural dif-

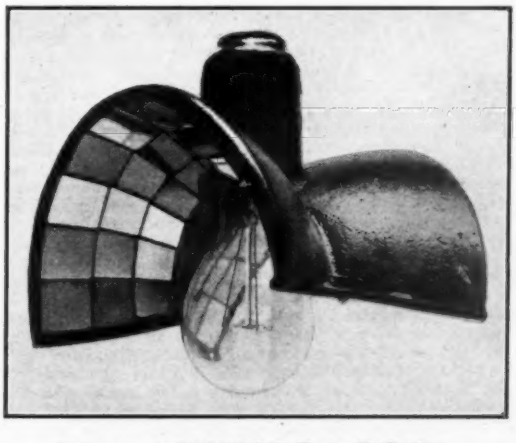


Fig. 5.—"Bi-Multi" Type Reflector.

fused daylight. The glassware of the last mentioned is designed on a scientific basis to correct the light from the lamp, and when used in conjunction with modern electric lamps produces an artificial illumination with a high degree of approximation to natural light. This company also exhibited a flashing traffic signal and direction indicator, K-Ray illumination cases for displaying notices, &c., outside public buildings and in railway stations, flood-lights suitable for outside use, and a

full range of Siemens electric lamps, including the popular pair—Siemens "Pearl" and "Silvalux Opal" gasfilled lamps.

The ELECTRIC STREET LIGHTING APPARATUS Co. exhibited a range of the "Bi-Multi" type reflector, fig. 5, including the large size for 750-W lamps, the intermediate size for 200/500-W lamps, the smaller size for 60/150-W lamps, and variations of this type, arranged for road junctions, three-way and four-way. The "Croydon" type of reflector and variations of it were also displayed, each using only one lamp for the directional lighting of one-day, two-way, "T"-junction or four-way cross-way points. This was also shown arranged in duplicate to form a lantern, both this and a triplicate type having been largely adopted. The makers' new adjustable directional fitting for junctions and cross-roads consists of a separate reflector for each direction, arranged on a common centre, each reflector being focused by simply turning it on the top thread and securing it with a set-screw; this is supplied with reflectors of either the "Bi-Multi" or "Croydon" type, as preferred. To meet conditions of open spaces, or where directional lighting is not required, the company has designed a particularly effective symmetrical distribution fitting, the "W.A.B." lantern, which gives a very high result for this method of illumination. A new type of conversion reflector fitting, designed specially for Beckenham, is worthy of the consideration of engineers who are converting existing gas lanterns. This fitting has a very simple arrangement for placing in an existing gas lantern, and when at a later period the lantern frame becomes worn out, or it is decided to dispense with it, a small top canopy casting can be supplied at a nominal cost, which converts the reflector into a complete outside unit ready for screwing direct on a standard bracket. Another feature of this exhibit is the makers' patent line fuses and connectors for use in connection with overhead lines. Sample of E.S.L.A.C. standard ironclad switch fuses and a very convenient type of time switch and fuse box for mounting on a spigot of the usual type of C.I. column were also displayed.

The "Radiovisor" automatic lighting unit for street lamps was shown by RADIOVISOR PARENT, LTD. It consists of a light-sensitive bridge, which is placed in a convenient position where daylight may affect it, and a sensitive polarised relay which operates a local-circuit snap switch. The bridge is worked directly from the lighting voltage, and controls the sensitive polarised relay, which is of practical and sound construction, designed to deal with currents of the order of those handled by the bridge. The relay can be adjusted for sensitiveness by moving the pointer thereon. The relay works the polarised snap switch, which carries independent tungsten contacts of a robust nature, which actually perform the operation of switching on and off the lamp, and are capable of handling up to 5 A. The whole unit is of rigid construction, and being enclosed in a metal box it is immune from weather influences and accidental damage. When applied to the automatic lighting of street lamps it may be fixed to a lamp standard as in fig. 3, or placed under the cowl of a lamp. In every case the design of the apparatus can be made to conform with the general design of the lamp standard. The above description of the "Radiovisor" unit applies to the d.c. unit, but an a.c. model can also be supplied.

An interesting range of street-lighting fittings was displayed by Messrs. KORTING & MATHIESEN ELECTRICAL, LTD., including the "Kandem," "Farlite," "Throlite," and "Mirrorlite" patterns. The exhibits on this stand also included the long-burning "Dia" flame-arc lamp.

On the stand of the HORSTMANN GEAR CO., LTD., was to be seen a representative range of "Newbridge" time switches. These switches are British made throughout, except the Swiss escapements, and are fully guaranteed.

BROMFORD TUBE CO., LTD., showed several types of new lighting standards in seamless steel for electric and gas lighting, and also some interesting island guards. A new tapered lamp column has been recently introduced by this company.

The GENERAL ELECTRIC CO., LTD., had an interesting series of exhibits appertaining to street lighting, much of which had never before been demonstrated outside the G.E.C. research laboratories. The abolition of central station control of street lamps is forecast by the new "Osram" photo-electric cell street-lighting control apparatus, which not only switches on without controlling apparatus, but does so at all hours of the day when daylight falls below a prescribed minimum standard. Similarly, as darkness ceases and daylight returns to normal the lamps are extinguished. An exhibit of exceptional interest and value was optical apparatus by means of which it is possible to visualise the appearance of a given street when illuminated in different ways. It can be arranged by a simple switching operation to portray nine different types of lighting with various wattages of lamps in six different streets. The object of this apparatus is to enable public lighting engineers to visualise the appearance of any one of their own streets under different types of lighting, and so select the one which is considered most suitable.

A feature of the G.E.C. display was a new small asymmetric silvered-glass reflector. This fitting is of the "open" type, and has been designed for use with 60-, 100- or 150-watt lamps. It gives an asymmetric distribution of the non-axial type, the angle between the direction of maximum luminous intensities being 160 degrees. This fitting has been designed for those who prefer a sharp cut-off, so as to have a minimum of glare. With 100-watt lamps mounted 14 ft. 6 in. high on a staggered system, the posts being spaced 160 ft. apart on a 25-ft. road, this reflector permits of a B.E.S.A. Class G installation being obtained. With 60-watt lamps, 120-ft. spacing, and a similar height and road width, the same class may be attained. As the luminous flux is in large measure restricted to the road surface, the coefficient of utilisation is high. Another item seen on this stand, a small asymmetric single-piece prismatic glass refractor, is designed to be used with 60-, 100- or 150-watt lamps, the light sources being visible, although at the correct post height they are not glaring. As glare is measured by excessive illumination on the eye, this has been curtailed within reasonable limits, and the magnification factor of this fitting does not therefore exceed 6 to 1. The fitting enclosing the refractor is of the "non-ventilated" type. The visual result is more in accordance with current practice, but there is very little difference from the equivalent reflector fitting in actual illumination on the road surface. Examples of the effect of the controlling of the rays of light on the road by means of asymmetric refractors formed another demonstration of unusual interest.

By no means the least interesting of the exhibits staged by the G.E.C. was a series of enlargements of actual night photographs of installations carried out in various parts of the country by means of Wembley lanterns equipped with different types and wattages of lamps, including, of course, special examples showing the new lighting of the Thames Embankment.

An exhibit of particular interest to those responsible for the regulation of road traffic was the street traffic signalling apparatus of the Siemens & General Electric Railway Signal Co., Ltd., which was to be seen on the G.E.C. stand. The S.G.E. Co. has now developed a system for the control of street traffic. The controller or automatic timing switch is of special interest in that a number of detrimental features to be found in the controllers hitherto available have been eliminated. No motors or other rapidly revolving parts are employed, and thus wear and tear is reduced to an absolute minimum. The apparatus can be operated by direct or alternating current of any commercial voltage or frequency, without alteration. Signals may be arranged to operate simultaneously in groups, or succeeding groups may change successively or progressively, or, further, the groups may be staggered. Manual control is also catered for. The setting of the controls is extremely simple and understandable, the switches being assembled on a front panel with clearly engraved markings. The latest recommendations of the Ministry of Transport in regard to the switching of the signals have been provided for, and the S.G.E. controller will be found to meet all requirements. Special attention is drawn to the Ministry's recommendation of giving a red and yellow signal simultaneously. This facility is provided in the S.G.E. controller. The signals are substantially constructed in light-weight castings, and can be arranged for mounting on posts or walls—singly or in groups. Pedestal and suspended types for fixing in the centre of an intersection are also available. Special attention has been devoted to the optical system to produce maximum noticeability, wide dispersion and minimum interference from sunlight.

The Blackburn Electricity Undertaking.

The Council Adopts Recommendations for Re-organisation.

THE special committee appointed to investigate the Blackburn Electricity Department, to inquire into its organisation and management, and recommend such measures as it thought proper to improve its efficiency, has reported that, from the evidence submitted to it, it is satisfied and unanimously finds that the organisation and management of the commercial side of the undertaking are unsatisfactory, and recommends:—

(*a*) That the services of Mr. P. P. Wheelwright, electrical engineer and manager, be dispensed with as from September 30th, 1929, and that he be paid one year's salary (£1,000) in lieu of notice.

(*b*) That a new electrical engineer and manager be appointed from outside the department.

(*c*) That the duties of Mr. G. W. Turner, at present the chief assistant engineer, be at once re-adjusted and limited to the engineering side of the department, and that, as and from January 1st, 1930, his salary be reduced from £752 2s. to £600 per annum.

(*d*) That after the appointment of a new electrical engineer and manager the Special Sub-Committee continue its inquiries with the assistance and advice of the new electrical engineer and manager into the staffing of the department, and report thereon and upon any other matters in connection with the department coming within the scope of the terms of reference.

The full Electricity Committee has placed on record its appreciation of the services of the Special Committee, and has decided that applications for the position of electrical engineer and manager, at a salary of £1,000 per annum, be invited by advertisement, the engagement to be terminable by three

months' notice on either side, the person appointed not to be allowed to engage in private practice or to take premium pupils.*

The Special Committee was appointed to reduce the applications to three in the short list.

The Council Debate.

There was a "full-dress" debate on the subject at the Blackburn Town Council, on September 5th, when a letter was read from the National Association of Local Government Officers and Associated Municipal Electrical Engineers "protesting most strongly at the proposal of the Electricity Committee to dispense with the services of Mr. P. P. Wheelwright, electrical engineer." "We are acquainted with all the circumstances attending the meetings of the special sub-committee which Mr. Wheelwright, together with his counsel, has attended, and we feel that the report does not represent anything like a reasonable case for the drastic action which is recommended therein. We beg to submit that we are asking for nothing more than common fairness in suggesting that, before the report is adopted, the whole of the circumstances should be submitted to a public inquiry by an independent tribunal. In support of this request we submit:—

"(1) That the present report cannot be regarded as the product of an unbiased tribunal. It will be remembered that several members of the committee who signed the report were responsible for calling the inquiry.

"(2) That it is impossible for us to eliminate from our minds that the decision is influenced by party politics.

"(3) That there is at stake Mr. Wheelwright's professional career, and the recommendation is all the more alarming when we consider that Mr. Wheelwright has given 25 years' expert and diligent service to the Blackburn Corporation.

"(4) That few, if any, present members of the Blackburn Town Council can remember the long and faithful service which Mr. Wheelwright has given the ratepayers of Blackburn, particularly in the early days when the industry was being built up.

"We feel sure the Town Council will realise that there does not appear in the report to be sufficient justification for the very drastic step contemplated, and that the Council will acquiesce in reasonableness of this joint request in the interest of justice to a faithful public officer."

Councillor CRITCHLEY (chairman of the Electricity Committee), in replying to questions, said it had always been said by their engineer that a firm could lay cables more cheaply than the Corporation could, and the firm was entrusted with the work. Since the end of last year, however, the work had been done by the Corporation. On the question of cable contracts, the committee now obtained quotations for cables and most of the goods which it required. The first time it asked for tenders for cables there was a large saving. On one order of a little over £1,000 the saving was £95. He had not been authorised to make any statement on the subject of apparatus. Not only had members of the Council received apparatus, but members of the Board of Guardians, the Education Committee, and others. They were encouraged to have it, the idea being to develop a good domestic load. Some had argued that the experiment was worth while. He did not think any good purpose would be served, at the moment, by giving the names of those who had received appliances. They might very well have excuses or explanations to offer, and he did not think it was his duty to make the names public, because the special Sub-Committee was still going on with its work, if its report was approved.

Answering Alderman HAMER, Councillor CRITCHLEY said he believed Mr. Wheelwright had had a copy of the report, not only of the present inquiry, but of every finding of the Sub-Committee, 14 meetings of which had been held, many lasting all day. Mr. Wheelwright had had fair play from beginning to end.

Alderman HAMER: Has the result of these negotiations been conveyed to him, and also what it means to him?

Councillor CRITCHLEY: Yes, every time.

Alderman HAMER then moved the report back on the ground that it did not give the "ins and outs," and the reasons which prompted the Committee to come to its decisions. Although he held no brief for Mr. Wheelwright, one had to recognise his 25 years' service with the Corporation, and in justice to him—his honour and bread and butter being at stake—the request for a public inquiry should not be turned down. Mr. Wheelwright was entitled to it.

Councillor EASTWOOD, seconding, asked if the previous chairman and vice-chairman of the Committee were to escape criticism.

Councillor BEARDSWORTH supported the adoption of the minutes, and said he did not think the Sub-Committee would have finished its task until it had got to the bottom of the whole matter.

Councillor BROTHERS, M.P., said, in his opinion they were being side-tracked from the main issue. Either the Council had or had not the power to engage or discharge as they thought fit. Members of the Council were responsible to those who elected them, but the electrical engineer was responsible to the Council. The point he did not like about the letter from the N.A.L.G.O. and the Associated Municipal Electrical Engineers was its direct insult to the members of the Council. It charged them with sinking their honour for party politics, and with putting party politics before straight, honest dealing. "I am not having that," added Mr. Brothers. He thought the letter was ill-advised. The facts placed before the Council were sufficient to justify it in dispensing with its engineer's services. He did not favour deputing the duties and responsibilities of the Council to any public committee of inquiry. If they could not conduct their business efficiently and well, it was time the people who sent them there got others who had the ability and were able to shoulder the responsibility.

Councillor TAYLOR explained the legal position. He said: "There is no agreement with the electrical engineer, providing for the length of notice to be given to terminate his employment with the Corporation." That being so, the ordinary law applied just as it did between any employer and worker. According to decided authorities, the notice must be a reasonable one, and what was reasonable depended upon the circumstances. If the matter were decided by a Court, it would probably be held that a man in the position of the electrical engineer was entitled to 12 months' notice, or to 12 months' salary in lieu of notice. If the Corporation dismissed its engineer without reasonable notice or salary in lieu of notice, he could commence an action. In this case, the Special Committee, having come to certain conclusions of fact, it was doubtful whether there was any case for dismissing Mr. Wheelwright without notice and without compensation, and Court proceedings would have been a slow and expensive procedure.

Councillor TAYLOR said it would have been impossible for the Sub-Committee to have set out in detail all the reasons for its conclusions. There were six members, and what might have influenced one might not have influenced another. They carefully considered the evidence, and gave Mr. Wheelwright every opportunity of being heard and calling witnesses. The speaker took strong exception to the letter read from the two organisations referred to. It was an insult to the Council, and he was sorry it had ever been written. They would notice that the letter did not quarrel with the findings of the Committee, but with its recommendations. He strongly opposed the suggested public inquiry by an independent tribunal. What guarantee was there that the Council would adopt its report, if the suggestion was followed. It was equivalent to telling the Council that it had no men who were capable of conducting an inquiry. Moreover, it had never been suggested from beginning to end that there should be a public inquiry of this sort, either by Mr. Wheelwright or his counsel. It was untrue to suggest that any bias had been shown. On the contrary, members of the Sub-Committee had shown a feeling the other way. They did their utmost to give Mr. Wheelwright fair play from start to finish. The suggestion that they were influenced by party politics was absolutely untrue, and ought never to have been made. Politics had never entered into the matter. They were as impartial and fair as any six men could be. So far as their public duties were concerned, they would never be influenced by party politics. The present report was, as it were, an interim one. They had got to a certain stage, and they wanted certain assistance. No doubt other recommendations would be made, and they would then have the assistance of the new engineer. He would not have objected to a public inquiry at the beginning, but he did object now.

Councillor H. JOHNSON supported the minutes.

Alderman HIGHAM said that he took full responsibility for whatever steps he had taken when chairman of the Electricity Committee. He had never tried to shelve it or put it on the engineer. That money had been lost on the Darwen contract was purely a matter of opinion. He believed that an inquiry would show that, instead of money being lost, the Corporation had gained money. The contract was still in existence, and if it was not profitable why had the terms not been altered? He justified the distribution of apparatus on loan, and said it was done with the full knowledge of the Committee and the Council. The object was to get people accustomed to the use of electricity for domestic purposes. Its success was indicated by the fact that the domestic load had been built up from practically zero to over two million kWh per annum. He thought a good deal of the enthusiasm in the search for names was that some people expected to find his among them. Unfortunately for them, it was not there. The chemist at the Whitebirk station was appointed because the Corporation was threatened with a lawsuit by surrounding owners of land. That expense had been fully justified by results. The report suggested that they were trying to shelve something of an incriminating character. It ought to be made perfectly plain to the public that there was no suggestion of this sort. Their engineer had had the use of free electricity ever since his appointment for testing purposes, and it was a right exercised by electrical engineers throughout the country. "I, for one, am not resting content to take even the unanimous vote of six individuals to get me to cast my vote against an official who has served us so long and faithfully as Mr. Wheelwright has done." There had been investigations by a reputable firm of accountants, who found matters satisfactory, and the report of the expert engineer consulted by the Corporation had been described to him as one long eulogy of Mr. Wheelwright.

Councillor EDDIE described Alderman Higham's speech as exceptionally clever from the point of view of side-tracking. Nothing would have pleased him more than the opportunity of answering him point by point. But he was not going to reduce the discussion to the sort of thing Alderman Higham had indulged in. He had paid no attention to the reasons given in the report for their recommendation—the organisation of the department and its management on the commercial side, which were stated to be unsatisfactory. The Sub-Committee

* The position is advertised in this issue.—EDS. ELEC. REV.

started its investigations on this principle: that Mr. Wheelwright would not be able at the end to say that he had not had every conceivable consideration. They had done everything possible to help him. Indeed, they had put themselves to a great deal of inconvenience to give him the fullest opportunity of presenting his case. Someone had asked for facts. Might he suggest that the Sub-Committee had perhaps adopted the habit of the Scot in this matter—it was being cautious and not committing itself. Perhaps those acquainted with law would understand what that meant. He appealed to the Council to pin some faith in this report; to put some faith in the six disinterested men who had spent 14 days inquiring into the matter, and to accept their findings. They had gone into the whole of the facts as carefully as any public inquiry could possibly have done. They would notice that the report proposed that the basis on which they appointed a new engineer would be somewhat different from that upon which the last engineer was appointed. There would be three months' notice on either side, there would no longer be premium pupils, and the engineer would not be able to indulge in private practice. These were reforms which the Sub-Committee thought advisable and necessary. He asked the Council to accept the report in the best interests of the Corporation and the public at large. Let them make a clean start, and wipe away a lot of things which had hindered the department hitherto. He appealed to Alderman Hamer to withdraw the amendment.

Alderman HAMER said he hoped the Committee did not think there was any suggestion of dishonesty in the reference back. He appreciated their services in dealing with a very painful matter, but he felt the information placed before them did not justify the dismissal of a man who had held a high position for 25 years. It had always been his aim to do everything honourable as between man and man, and as Mr. Wheelwright had asked for a public inquiry, he ought to have another chance of presenting his case.

The amendment was defeated by an overwhelming majority, there being only nine votes in its support.

Correspondence.

***Correspondents should forward their communications as early as possible.** No letter can be published unless we have the writer's name and address in our possession.*

Electricity in Holland.

I was very interested in the article which appeared in the ELECTRICAL REVIEW on August 23rd.

After reading it, I read it once again and then took down the map of the world to see if there were two Hollands shown on it.

I am, however, now convinced that there is only one, and that Mr. Mortimer must be referring to the country with whose name and customs we are all acquainted.

My reason for doing all this was due to one statement made by Mr. Mortimer. He states that "there is no overhead distribution whatsoever, which is distinctly surprising, &c."

When passing through Holland recently, I was so struck with the number of overhead poles, transformers, and all sorts of gadgets, that a number of pictures were taken for future lantern slide purposes.

It seems strange that Mr. Mortimer did not see any of these, as they are spread out all over Holland.

However, the photographs enclosed give you a rough idea as to what one may expect to come across in Holland.

You will observe that figs. 1 and 2 show a large central cast-iron pillar, containing a transformer and all sorts of links and busbars.

Coming out on top of these, at all sorts of angles, are insulators, brackets, hooks, &c., all running in different directions to various points on the street walls.

You will also observe from another picture, fig. 3, the method of running overhead along the outside of walls, such as hotels, banks, and other large buildings. You will observe that the overhead lines are tapped at various points by cables, which are unsupported between the joint and overheads and the junction box on the wall, fig. 4.

The method of running into a building is rather amusing, and confirms just what Mr. Mortimer himself says about the supply people and the consumer arranging between themselves as to the most convenient place in the building to run the mains. It seems to me that they just all put their heads together, and then say, "Oh, any old place will do, old chap."

To give an instance, I observed a pair of cables running from a dividing box, 30 ft. up the wall, down to a cast-iron box built in flush with the outside of the wall and fitted with a cover wth thumb screws, and no other protection. Anyone could open these covers to see what was inside. Altogether, their arrangements are very crude, but, at the same time, no one seems to worry about looks at all.

I happened to wander into a hairdresser's shop for the usual trim, and was very surprised to note the up-to-dateness of the methods and the appliances in such places. In this country, one is accustomed to our barber friend with his scissors and comb, but across in Holland one gets a trim with a small cutter which is operated from a small transformer. Very smart appliances indeed, but a person from this country can only have a slightly nervous feeling when he knows that his feet are actually resting on polished brass plates, which are in the form of protection covers and are attached to the main pipes and iron-work of the wash-basins.

I also observed another gentleman having some special process carried out on his cranium, and the appliances in this case consisted of a beautifully nickel-plated blower arrangement with a sort of fork passing through his hair; this electical appliance was neatly clamped round his neck, and here again his feet were on one of the polished brass plates. Of course the gentleman no doubt would not be aware of the dangers when sitting in a position like this with the appliances clamped round his neck, and perhaps it was just as well that he was not aware of it.

The wiring in most of the towns which I visited consisted of the tubing-cum-cleats-cum-staples-cum-bellwire-cum-anything at all.

Fittings in large dining-rooms, I observed, were hung from the roof with a galvanised hook, then 4 in. or 5 in. wood block, and the ceiling plate attached to the block. The wiring in some cases actually passed through the roof at a point 6 in. to 8 in. away from the ceiling block, and I observed in one case four porcelain cleats hanging over the edge of the block.

You will see by this that anything at all evidently does in Holland, and I am afraid that, apart altogether from rules and regulations, such methods would be eyesores to anyone in this country.

J. Walker,

For the WALKER ELECTRICAL SERVICE.

Edinburgh, *August 31st*, 1929.

Fig. 1.

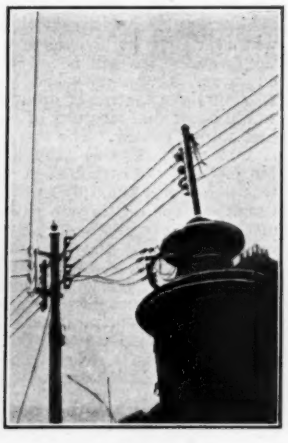


Fig. 2.

Fig. 3.

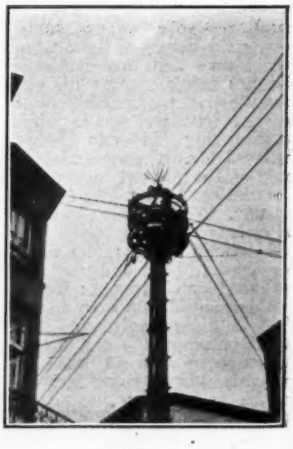


Fig. 4.

My Electric House.

I fully appreciate the view of Mr. Sims, in your issue of the 23rd inst., that the results of my household records contained in my recent article are not fully complete unless the number of persons comprising the family is mentioned. I purposely omitted this information, because I anticipated, in any case, criticism on this point, and I am very glad that Mr. Sims has raised it, since this affords me an opportunity of making a few remarks on a popular fallacy with regard to this matter. It is customary in propaganda literature, especially that pertaining to electric cooking, to state the consumption of current as so many units per person per day. This, in my opinion, is entirely wrong. It is not so much the number of persons which affects consumption, but rather their *habits*. In the twelve months under review in my article, the house-

hold consisted of my wife, myself, and a very important personage who had only just seen his first birthday at the commencement of this period. Such a household of two adults and a child would be said to consist of three persons, but I have no hesitation in saying that on account of the extra heating involved for airing and drying clothes, and cooking for the preparation of special food necessary for a young child, the current consumption is at least equal to that which would be expected for a family of four or five adult persons.

I must confess that I do not quite see the drift of some of the remarks of Mr. Williams in to-day's issue. It is just because the feeling exists "that we are too apt to expect the consumer to make the first move . . . and do not offer sufficient inducement to the prospective extending consumer," that my article was prepared, in the hope that it and similar records of other actual domestic installations would be of real practical value for business-getting purposes. Mr. Williams appears to have suspicions that, because I happen to be an engineer engaged in the electricity supply industry, I receive my "juice" free. I do not think he can have read my article carefully in this connection, otherwise he would have observed the details I gave regarding the tariffs adopted and the amount of the yearly bill. I can assure him that I am treated in exactly the same way as any other customer. As regards the fabulous salary which he expects I receive, inquiry in the right quarter may no doubt enlighten him on this point. The meeting to which I referred, and which showed such a lamentable lack of all-electric house enthusiasts, consisted entirely of professional electrical men, the vast majority of whom, I am sure, if they went carefully into the matter, would find that they are spending considerably more on their homes when using coal, gas, &c., than if they adopted the all-electric method. No, Mr. Williams, the proof of the pudding is in the eating. I am thoroughly satisfied with the service and results that I obtain for my £27 a year, and—what is more to the point—so is the "Home Chancellor of the Exchequer."

Reg. H. Rawll.

Birmingham, *August 31st*, 1929.

Some letters have unavoidably been held over on account of pressure on our space.—EDS. ELEC. REV.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken

1928.

4,450. "Directional aerials for the transmission and reception of electromagnetic (wireless) waves." W. E. Williams. February 13th, 1928. (317,301.)
(wireless) waves." W. E. Williams. February 13th, 1928. (317,301.)
4,451 "Voltage regulators for electric generators." B. Sykes. February 13th, 1928. 317,302.)
4,628. "Electrical fuses." R. Lomax, J. R. Garner, and P. C. Walker. February 16th, 1928. (317,409.)
5,062. "Electric transformers." F. W. Gee and Ferranti, Ltd. February 17th, 1928. (317,494.)
8,153. "Electric protective systems." A. Reyrolle & Co., Ltd., and H. Leben. March 17th, 1928. (317,497.)
8,174. "Electric protective systems." A. Reyrolle & Co., Ltd., and H. Leben. March 17th, 1928. (317,498.)
11,034. "Telephonic loud-speaker." F. W. Lanchester. April 14th, 1928. (317,339.)
11,468. "Radio receiving apparatus." Igranic Electric Co., Ltd., and F. J. H. Charman. April 18th, 1928. (317,503.)
11,493. "Manufacture of electric discharge devices." General Electric Co., Ltd. (Dr. A. Just). April 18th, 1928. (317,504.)
13,358. "Filter device for operating multi-stage thermionic amplifiers with supply units." Loewe-Radio Ges. May 6th, 1927. (290,169.)
13,953. "Sound-reproducing instruments." British Thomson-Houston Co., Ltd., and A. T. Stace. May 11th, 1928. (317,305.)
13,997. "Diaphragm for loud-speakers." Dr. S. Loewe. May 13th, 1927. (290,299.)
14,113. "Thermionic valve circuits." Edison Swan Electric Co., Ltd., and T. F. Stent. May 14th, 1928. (317,351.)
14,123. "Method of charging electrical furnaces." A. L. Mond (I. G. Farbenindustrie Akt. Ges.). May 14th, 1928. (317,416.)
14,153. "Electrical terminals." D. E. Barnett. May 14th, 1928. (317,354.)
14,332. "Electric lampholder switches." J. A. Crabtree. May 16th, 1928. (317,514.)
14,364. "Electric meters and selective remote-control systems employing such meters." A. Reyrolle & Co., Ltd., and B. H. Leeson. May 16th, 1928. (317,422.)
14,373. "Telephone or like systems with amplifiers." General Electric Co., Ltd., and E. H. Cribb. May 16th, 1928. (Cognate application, 29,370/28.) (317,423.)
14,375. "Slip rings and other current-collecting devices." J. A. Colombi. May 16th, 1928. (317,424.)
14,392 "Strand-coating apparatus." W. E. Beatty (Bell Telephone Laboratories, Inc.). May 16th, 1928. (317,425.)
14,393. "Electro-optical image-producing systems and apparatus therefor suitable for television." W. E. Beatty (Bell Telephone Laboratories, Inc.). May 16th, 1928. (317,426.)
14,416. "Oil-immersed switches." A. West & Co., Ltd., and A. West. May 16th, 1928 (317,429.)
14,417. "Electrical grid resistances." A. West & Co., Ltd., and A. West. May 16th, 1928. (317,517.)
14,564. "Electro-mechanical hammers." Siemens-Schuckertwerke Akt. Ges. May 24th, 1927. (291,027.)
14,621. "Non-numerical switching arrangements for automatic and semi-automatic telephone systems." Standard Telephones and Cables, Ltd., and E. P. G. Wright. May 18th, 1928. (317,521.)
14,622. "Dial switches." Standard Telephones and Cables, Ltd. (G. Deakin and L. J. J. Schreiber). May 18th, 1928. (317,522.)
14,623. "Sub-harmonic electric frequency producers." Standard Telephones and Cables, Ltd. August 20th, 1927. (295,930.)
14,624. "High-frequency signalling systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). May 18th, 1928. (317,523.)
14,739. "Synchronising systems." W. E. Beatty (Bell Telephone Laboratories, Inc.). May 19th, 1928. (317,528.)
14,948. "Synchronising systems." W. E. Beatty (Bell Telephone Laboratories, Inc.). May 22nd, 1928. (317,537.)
15,057. "Electrical signalling systems." Automatic Telephone Manufacturing Co Ltd., and G. A. Burns. May 22nd, 1928. (317,547.)
15,868. "Effecting chemical reactions in gases by means of electrical discharges." P. H. Hull and Imperial Chemical Industries, Ltd. May 31st, 1928. (317,558.)
16,060. "Electric accumulators." E. Parville et Cie. June 14th, 1927. (292,122.)
16,314. "Method of impregnating high-tension electric cables." Felten and Guilleaume Carlswerk Akt. Ges. June 3rd, 1927. (291,722.)
16,341. "Wireless receiving systems." G. W. Hale and Radio Instruments, Ltd. June 5th, 1928. (317,566.)
17,129. "Radio receiving apparatus." A. Preen. June 13th, 1928. (317,574.)
17,584. "Speed-controlling mechanisms for motor drives." International General Electric Co., Inc. June 18th, 1927. (292,478.)
18,330. "Sound reproducers." Brandes, Ltd. July 30th, 1927. (294,875.)
18,481. "Devices for removing and replacing electric bulb lamps." J. Grant and W. H. Grant. July 2nd, 1928. (317,583.)
19,619. "Switch device for electric irons." J. W. Patrick. July 6th, 1928. (317,597.)
19,704. "Air-release valves for tramway and other compressed-air brake systems." Electro-Mechanical Brake Co., Ltd., and S. Smith. July 6th, 1928. (317,599.)
19,778. "Resistance-capacity coupling units for use in radio apparatus." Igranic Electric Co., Ltd., and W. K. Alford. July 7th, 1928. (317,600.)
19,802. "Manufacture of X-ray anodes." British Thomson-Houston Co., Ltd. July 15th, 1927. (293,864.)
20,018. "Shade fitting for electric lamps." General Electric Co., Ltd., and J. H. Jones. July 10th, 1928. (317,603.)
20,173. "Thermally-operated electric switches." General Electric Co., Ltd., H. C. Turner, and A. Sherwin. July 11th, 1928. (317,605.)
20,719. "Radio receiving apparatus employing tetrode valves." Igranic Electric Co., Ltd., and D. Sinclair. July 17th, 1928. (317,610.)
20,730. "Electrical switchgear." T. C. Christianson and Associated Electrical Industries, Ltd. July 17th, 1928. (317,611.)
21,201 "Devices for actuating the switch-arm of electric light and like switches." G. W. M. Fletcher. July 21st, 1928. (317,613.)
21,206. "Mountings for electric light reflectors." General Electric Co., Ltd., and T. E. Ritchie. July 21st, 1928. (317,614.)
22,808. "Production of electric signalling impulses." British Thomson-Houston Co., Ltd. August 8th, 1927. (295,284.)
23,522. "Control of dynamo-electric machines." British Thomson-Houston Co., Ltd. August 16th, 1927. (295,654.)
24,157. "Electromagnetic sound-reproducing devices." Brandes, Ltd., and M. S. Hoban. August 22nd, 1927. (Cognate application, 24,158/28.) (317,641.)
24,208. "Apparatus for the measurement of the capacitance and power factor of electrical condensers." A. Campbell. August 23rd, 1928. (317,642.)
24,480. "Electric cells." W. R. Edwards. August 25th, 1928. (317,647.)
26,047. "Means for applying radio-activity for curative purposes." G. E. Heyl. September 11th, 1928. (317,655.)
26,836. "Trays or stands for use in charging and/or filling electric accumulators or storage batteries." J. Steele & Sons, Ltd., and H. Steele. September 19th, 1928. (317,661.)
28,566. "Electric lamp cap." T. Cracknell and E. M. Austin. October 5th, 1928. (317,666.)
28,641. "Methods of, and means for bonding together electric cable sheaths." H. Halperin and K. W. Miller. October 6th, 1927. (298,237.)
28,865. "Apparatus for the interconversion of sound and electrical impulses." British Thomson-Houston Co., Ltd. October 8th, 1927. (298,482.)
29,436. "Combined electric switches." F. R. Francke. October 12th, 1928. (317,667.)
30,180. "Inductances for use in high-frequency circuits, for example, in radio receiving sets." Siemens & Halske Akt. Ges. October 18th, 1927. (298,990.)
33,000. "Thermionic amplifiers." E. Asch. November 10th, 1927. (300,511.)
35,372. "Diaphragms for sound-reproducing or receiving instruments." P. Lannon and D. Lannon. November 30th, 1928. (317,696.)
36,028. "Apparatus for the interconversion of sound and electrical impulses." British Thomson-Houston Co., Ltd. December 6th, 1927. (Patent of addition not granted.) (301,840.)
37,246. "Electric condensers." British Thomson-Houston Co., Ltd. December 21st, 1927. (302,729.)

1929.

21,772. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., C. Gillings, and C. H. Evans. April 19th, 1928. (Divided application on 11,627/28.) (317,531)
22,678. "Electric lampholder switches." J. A. Crabtree. May 16th, 1928. (Divided application on 317,514.) (317,532)
22,679. "Cord-grips for electric lampholders and the like." J. A. Crabtree. May 16th, 1928. (Divided application on 317,514.) (317,533.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from September 4th:—

Emb (lettering and design). No. 504,491. Class 6. Machinery and parts thereof.—Electro-Mechanical Brake Co., Ltd., Moor Street, West Bromwich.

Atsa. No. 500,794. All goods in Class 8.—Société des Accumulateurs Tudor, Brussels. (British representative: Douglas Elkington, 20-23, Holborn, E.C.1.)

Memota. No. 502,077. Class 8. Thermostatically-controlled switches for use in connection with electric motors.—Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.

Pedigree. No. 504,217. Class 8. Instruments and apparatus for radio signalling, sound reproducers, thermionic amplifiers and parts, &c.—Harold Taylor, "Woodhill," Compton, Wolverhampton.

Bezeg Plug Connection, A.B.L. (lettering and design). No. 501,200. Class 13. Plug connectors, wall plugs, and heating elements for electric stoves.—Bayerische Elektro-Zubehör Gesellschaft, Nuremburg. (British representatives: H. Gardner & Son, 173-175, Fleet Street, E.C.4.

Lubricating Commutator Brushes.

In many cases where hard brushes have to be used to suit operating conditions, there is considerable friction and screeching at the commutator owing to the lack of lubricant. The performance of these brushes can be improved by lubricating them as follows:

The brushes should be slowly heated to a dull red on an iron plate and then plunged in machine oil, where they should remain until cool.

Another method is to boil the brushes in paraffin wax. This has the same effect, but it must be done with due care and not with heat from an open flame, for heated paraffin wax gives off inflammable vapours.

The effect of this treatment is to cause part of the oil to enter the brush, which furnishes sufficient lubrication to enable the brush to run quietly, but not enough to cause smearing of the commutator.—*Power*, August 20th, 1929.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AYLESHAM.—Houses (50), for Aylesham Tenants, Ltd.; G. Lewis & Son, Ltd., builders, Dover.

BIRKENHEAD.—Junior school (700 places) and central school (1,200 places), Bedford Drive, for E.C. Church and schools; rector, Holy Cross R.C. Church, North End. Fire brigade premises, Borough Road (£25,000); borough engineer. Builder's workshops and stores, Palm Grove; architects' department, Co-operative Wholesale Society, Ltd.

BIRMINGHAM.—Baptist chapel, Yardley Road, near New Bridge Road; trustees. Art gallery, Cannon Hill Park; S. C. Kaines Smith, keeper, Museum and Art Gallery.

BLACKBURN.—Conversion of residence, Troy estate, into Girls' High School; director of education, Education Offices.

BOGNOR.—Premises, for Timothy White (1928), Ltd., Portsmouth; A. E. Cogswell & Sons, architects, Prudential Buildings, Portsmouth (returnable deposit of £1 1s.).

BOLTON.—Houses (178), Victoria estate; borough engineer. Development of estate, Heaton; T. S. Barlow. Extensions, Infirmary, Queen's Park; Infirmary Committee.

BOOTLE.—Housing scheme (216), Linacre Park; borough engineer, Town Hall.

BOSTON.—Water supply scheme (£35,000); surveyor to R.D.C.

BRADFORD.—R.C. school, Eccleshill; Rev. Dean Schrieber. Central omnibus garage, Moss Street and Ludland Street; city architect, Town Hall.

BRIDLINGTON.—Town Hall (£45,000), for the T.C.; borough surveyor.

BURNHAM (BUCKS.).—Two factories, Bedford Avenue, for Slough Estates, Ltd.

CARLISLE.—Employment exchange, Rickergate, for H.M. Office of Works, King Charles Street, London, S.W. Hall, St. Nicholas, for the Salvation Army.

CHELTENHAM.—Houses (64), Shakespeare Road; W. Drew.

CIRENCESTER.—Extensions, Driffield Manor, for Sir Herbert Ingram.

DENBIGH.—Alterations, North Wales Mental Hospital; G. P. Griffith, architect, 2, Post Office Lane.

DOVER.—Boys' County School, for Kent E.C.; J. J. Clayson, builder, Lyminge, Folkestone.

DUNDEE.—Extensions, King George V Wharf (£250,000); harbour engineer.

EASTBOURNE.—Alterations and additions, Lloyds Bank, Ltd., Seaside; A. G. Johnson, architect. Garages (27), Fitzmaurice Avenue; A. Ford, architect.

FARINGDON.—Housing scheme (52), for the R.D.C.; surveyor.

GLASGOW.—Houses (102), Braidfauld Street; housing director and trade contractors. Reconstruction of Empire Theatre; Moss Empires, Ltd. Extensions, premises, Great Western Road and Belmont Lane; Walter Hubbard, Ltd., 15, Smith Street, Hillbead.

GREAT OUSEBURN.—Housing scheme (56), for R.D.C. (deposit £2 2s.); G. W. C. Needham, architect, 29, High Ousegate, York.

IRISH FREE STATE (KILLESTER, Co. DUBLIN).—Houses (42), for the Irish Sailors' and Soldiers' Land Trust; W. J. Brown, architect, 50, Upper Mount Street, Dublin (returnable deposit of £5 5s.).

(MAYO).—Conversion of Creagh House, Ballinrobe, to sanatorium (£9,500); County Council.

IRLAM.—Housing scheme (50), Higher Irlam estate; W. G. Codling, surveyor to U.D.C.

LEAMINGTON.—Extensions, Parade; F. W. Woolworth and Co., Ltd.

LONDON (ST. MARYLEBONE, W.).—Building, Hereford Gardens; S. H. White & Sons.

(HOLBORN, W.C.).—Rebuilding 7-18, High Holborn, for Prudential Assurance Co.; J. H. Pitt, architect. Alterations, 53-4, High Holborn; George Venn, architect.

LUTON.—Estate development, off Montrose Avenue; B. B. Franklin. Handicraft centre, Beech Hill, for E.C. Factory extension, Charles Street; A. Horn.

MACHYNLLETH.—Nurses' home, King Edward VII National Memorial Hospital; Charles T. Ellis, architect, Aberdovey.

MANCHESTER. — 10,000 houses, Wythenshawe estate (£5,000,000); city architect. Library superstructure, St. Peter's Square (deposit £5); E. V. Harris, architect, 29, St. James' Square, Pall Mall, London, S.W.1.

MANSFIELD.—Rebuilding premises, Clerkson Street and Nottingham Road, for the T.C.; borough engineer (returnable deposit of £2 2s.).

MELKSHAM.—Works extensions; Avon India-Rubber Co., Ltd.

MORECAMBE.—Reconstruction, New Inn Yard area; borough engineer. Town hall, Calton estate (£60,000); Town Hall Committee.

NEWCASTLE-ON-TYNE.—R.C. church, Benwell; Stienlet and Maxwell, architects.

NORTHAMPTON.—Elementary school, Kettering housing estate, for E.C. Factory extensions; G. Webb & Sons, Brockton Street, and W. Barratt & Co., Ltd., Freehold Street. Houses (27), St. David's estate, for the T.C.; W. E. Cockerill, builder. Factory, Kingswell Street; Bassett Lowke, Ltd.

NOTTINGHAM.—Waterworks and sewage disposal works; city engineer.

PADIHAM.—Extensions to waterworks (deposit £5 5s.); G. H. Hill & Sons, civil engineers, 40, Kennedy Street, Manchester.

RAMSGATE.—Extensions, General Hospital (£8,946); W. T. Stock, architect, Queen Street; J. B. Sharman, Ltd., builders.

READING.—Block of shops and offices, Blagrave Street; Wheeler Bros., Ltd., builders, Caversham Road.

ROMFORD.—Extensions, nurses' home (£10,800), for the Board of Guardians; clerk. Tuberculosis blocks (£13,998), for the B.G.; Myall Bros., builders, Ilford.

RUGBY.—Additional 50 houses, for the R.D.C.; surveyor.

SALFORD.—Baths and public washhouse, Clarence Street, Broughton. Reconstruction scheme, Springfield Terrace area; city engineer.

SHEFFIELD.—Housing scheme (73), Westwood estate (deposit £2); W. G. Davies, city architect, Town Hall. Houses (42), Wybourn estate; M. Gleeson, Ltd. Washhouses, Upperthorne (£5,224); W. G. Robson.

SKIPTON.—Re-erection of Skyreholme paper mills, for Thomas Lumb & Co.

SOUTH SHIELDS.—R.C. church and schools; Rev. J. Deans, parish priest, Harton and Cleadon parish.

STANFORD-LE-HOPE (ESSEX).—School (200 places), for the R.C. managers.

STRETFORD.—Additions, offices, Westinghouse Road; Redpath, Brown & Co., Ltd. Alterations and additions, Chester Road; Manchester and Salford Co-operative Society, Ltd. Works extensions, Chester Road; Venos, Ltd.

SUNDERLAND.—Baths (£8,000); borough engineer.

TAMWORTH.—Additional 70 houses, Mile Oak estate, for the R.D.C.; surveyor.

WAREHAM (DORSET).—Re-erection of Lulworth Castle (electrically equipped), for H. Weld.

WATFORD.—Fire station and men's quarters; borough engineer.

WEST BROMWICH.—School (1,660 places), Charlemont estate; A. O. Chatterton, architect, Newhall Chambers, 8, Newhall Street, Birmingham.

WEYMOUTH.—Reconstruction of premises, East Street and Helen Lane, and extensions, Mitchell Street, for the Waterworks Co.; Gutteridge & Gutteridge, architects, 9, Portland Street, Southampton.

YORK.—Houses (31), Fleming Avenue, and flats (16), Tuke Avenue; city engineer. Estate development, Acomb; J. S. Barlow.